CHEMTRAC Systems, Inc.

The Process Optimization Company CSI

ECT 9800
OPERATIONS MANUAL

ON-LINE
ELECTROKINETIC CHARGE
TITRATOR

Optional pH and conductivity

Revised 05/07

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SYMBOL KEY

Do Not Perform This Function

Risk of Electric Shock

Note

Unplug Equipment!!

SAFETY PRECAUTIONS

BEFORE ATTEMPTING TO UNPACK, SET UP, OR OPERATE THIS INSTRUMENT, PLEASE READ THIS ENTIRE MANUAL.

MAKE CERTAIN THE UNIT IS DISCONNECTED FROM THE POWER SOURCE BEFORE ATTEMPTING TO SERVICE OR REMOVE ANY COMPONENT.

FAILURE TO FOLLOW THESE PRECAUTIONS COULD RESULT IN PERSONAL INJURY AND DAMAGE TO THE EQUIPMENT.

WARRANTY INFORMATION

Warranty: Chemtrac® Systems, Inc. warrants its product to be free of defects in material and workmanship for a period of one (1) year from date of shipment to the original customer. Upon receipt of written notice from the customer, Chemtrac® Systems, Inc. shall repair or replace (at the discretion of Chemtrac® Systems, Inc.) the defective equipment or components. Chemtrac® Systems, Inc. assumes no responsibility for equipment damage or failure caused by:

A. Improper installation, operation, or maintenance of the equipment.
B. Abnormal wear and tear on moving parts caused by some processes.
C. Acts of nature (i.e. lightning, flooding, etc.)

This warranty represents the exclusive remedy of damage or failure of the equipment. Under no circumstances shall Chemtrac® Systems, Inc. be liable for any special, incidental, or consequential damage, such as loss of production, profits or product quality. The warranty cannot be guaranteed if the customer fails to service and maintain the equipment in accordance with Chemtrac® System's written instructions and policies, as stated in the Operations Manual.

1.0 GENERAL INFORMATION

The Electrokinetic Charge Titrator (ECT) is an online charge analyzer and automatic titrator. The charge and charge demand can be quantified for 3 sample lines up to 4% consistency. This instrument is used to determine wet-end charge trends, as well as the effects of various additives on system charge. Therefore, the ECT is a useful tool for assessing and improving process efficiency.

1.1 STREAMING CURRENT AND CHARGE DEMAND

For a pulp sample or any aqueous solution, the ECT measures the **STREAMING CURRENT VALUE (SCV)**, a term which is commonly interchanged with "charge" or "charge measurement." The ECT filters pulp through a screen to obtain a sample suitable for the STREAMING CURRENT sensor. It is assumed that a STREAMING CURRENT is generated by electrically charged particles in the sample that are momentarily attached to the cylinder walls within the probe. A reciprocating piston causes fluid motion, which shears the loosely bound counter-ions away from the particles attached to the cylinder walls. Electrodes in the cylinder measure this current generated by the sheared counter-ions. The signal is electronically processed and the output is the SCV.

The loosely bound counter-ions, (mentioned above), are a component of the "double layer." This "double layer" concept is described in Section 1.2. Both STREAMING CURRENT and zeta potential are based upon the double layer principle. Therefore, the STREAMING CURRENT VALUE produced by the ECT is comparable to the well-known zeta potential.

The ECT also measures the **CHARGE DEMAND** of a sample by performing a titration. The pulp filtrate is titrated using a cationic or anionic polymer (titrant) of opposite charge and known charge density. The results indicate the volume of titrant required to reach a STREAMING CURRENT VALUE of zero, which means the sample has no net charge. This provides information about the sample's ability to absorb an oppositely charged material which is critical to additive performance and optimization. CHARGE DEMAND is measured to detect changes in charge before the furnish goes to the wire, allowing operators to determine:

- Interfering substances in the furnish (deleterious matter or anionic trash)
- Furnish charge compatibility with a given additive
- Additive type and addition rates for optimum retention/drainage
- Charge demand of incoming filler stream
- Charge demand of incoming broke, deinked/recycled pulp, or virgin pulp to determine their effect on total system charge

- Variations in headbox furnish charge and charge demand to achieve the slightly “anionic charge window” that most papermakers desire.

The STREAMING CURRENT VALUE and the CHARGE DEMAND are displayed and recorded by the ECT9800. Two 4-20mA outputs per sample line are used to transmit these results. The ECT also serves up web pages which can be viewed over an Ethernet connection or dialup.

1.2 STREAMING CURRENT AND THE DOUBLE LAYER

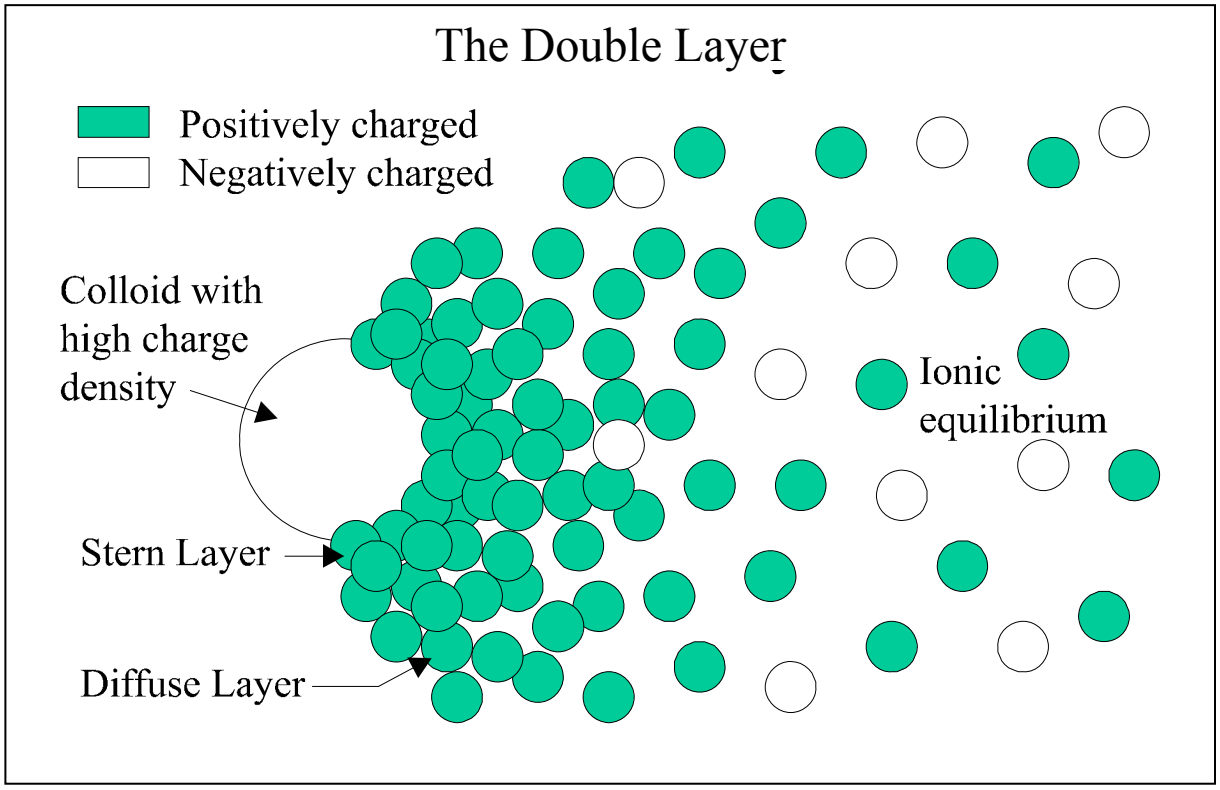
Surface chemistry and physics are important to papermaking chemistry, refining behavior, forming, and water treatment. One branch of surface chemistry is colloidal chemistry, the study of a stable combination of particles that are dissolved or suspended in a second substance. There are two important aspects of colloidal chemistry, the particle sizes (on the order of microns) and the net charge of these particles. Because of their small size, surface area plays a major role in their behavior, along with the charge density associated with each particle.

Most materials involved in papermaking have a net charge on the surface. For example, fibers, fines and fillers carry a net negative charge, as well as other papermaking additives. Additives that are cationic in nature are attracted to the anionic components. The cationic particles are tightly bound to the surface of the anionic colloid, thus forming the Stern layer. These cationic particles are also known as “counter-ions.” The electrostatic forces at this layer are strong enough to prevent displacement of the counter-ions by shear forces. Outside of the Stern layer is a grouping of counter-ions known as the Diffuse layer, hence the term “double layer.” This is depicted in FIGURE 1.

The ions in the Diffuse layer are further apart and can be displaced when a shear force is present. The ECA effects the shearing of counter-ions, and then measures the current generated by the movement of these cationic particles. This is how the streaming current value is measured by the ECA. The shearing of the counter-ions occurs between the Stern layer and Diffuse layer, known as the slip-plane.

As previously mentioned, the measurement of zeta potential is also based upon the double layer theory. The zeta potential is valid at the slip-plane. Essentially, the zeta potential is measured between the slip-plane and the bulk solution that is in ionic equilibrium. Whether streaming current or zeta potential is being measured, addition of an oppositely charged electrolyte will cause the slip-plane to contract towards the particle surface. As the slip-plane contracts, the STREAMING CURRENT VALUE (and zeta potential) will become less negative. Eventually, the isoelectric point will be reached, which is defined as a STREAMING CURRENT VALUE (or zeta potential) equal to zero. At the isoelectric point, the solution is considered neutral (no net charge.) If additional electrolyte is added, the system will become net cationic. Adding electrolyte to the sample is detailed in Section 4.3.

FIGURE 1


The Double Layer
Positively charged
Negatively charged
Colloid with high charge density
Stern Layer
Diffuse Layer
Ionic equilibrium

2.0 SPECIFICATIONS AND COMPONENTS

2.1 SPECIFICATIONS

Standard Features
ECT 9800 measures 3 sample lines (e.g. Tray Water, Headbox, Thickstock up to 4%)
Two (2) titrant pumps (Cationic/Anionic)
Chemical Wash Equipped
Touch Screen Display
Highly reliable thickstock sampling
Operation and Service Manual
Spare parts kit

1 filter	1 probes
1 pistons	1 viton seal
1 O-Ring kit	1 Cleaning brush
1 Piston tool	1 Pilot valve

1 Graduated cylinder

Optional Equipment
pH & Conductivity Analyzer

Power Requirements
115VAC, 60Hz
Optional 230VAC, 50Hz

Environmental Temperature
40 to 150°F (4 to 65°C)

Sample
0% to 4% consistency
10 to 50 gallons/min (40 to 190 L/min)
pH range: 3 to 9
Conductivity range: 0.1 to 3 mS/cm
Temperature range: 40 to 150°F (4 to 65°C)
Deliver to ECT and return to the process

Sample Connections
2"MNPT sample inlet for each sample line
2"MNPT sample outlet for each sample line
Optional 2" ball valve on sample inlet/outlet

Instrument Water
Filtered or potable
Pressure: 30-80 p.s.i.
Connection: ½" FNPT
Consumption: appr. 5 gallons (19L) per hour
Temperature: 60 to 150°F (15 to 65°C)

Instrument Air
Pressure: 60-100 psi
Connection: ½" FNPT

Dimensions
26"W x 30"D x 70"H (61cm x 61cm x 178cm)
200 lbs. (91kg)

Enclosure
Two NEMA 4X, 304 Stainless Steel

Materials in Contact with Sample

Delrin	Teflon
Neoprene	Viton
PVC	316 Stainless Steel

Measured Parameters
Streaming Current (Charge)
Charge Demand (mL, µeq, meq)
Optional: pH, conductivity
Rate: 7 to 15 minutes per sample line

Output Signals
Web Browser Enabled (802.11b or direct Ethernet connection)
4-20mA (250Ω Load), two outputs per sample line (for SCV and Charge Demand)
With pH analyzer, one additional output per sample line
With conductivity analyzer, one additional output per sample line
Six (6) Digital Outputs (+24 VDC)

Input Signals
Ten (10) Analog Inputs (Isolated)
Fourteen (10) Digital Inputs (Isolated)

Maintenance
Once every 2 to 4 weeks, clean sensor and refill titrant, refill chemical carboy (Chem Wash Option)
Once every 3 to 6 months, clean valves and filters

Titrants (Polyelectrolytes)
PolyDadmac (cationic) and PVSK (anionic)

Chemical Wash
Diluted household bleach (10:1)
Consumption: <50mL/hour

2.2 HARDWARE

FIGURE 2

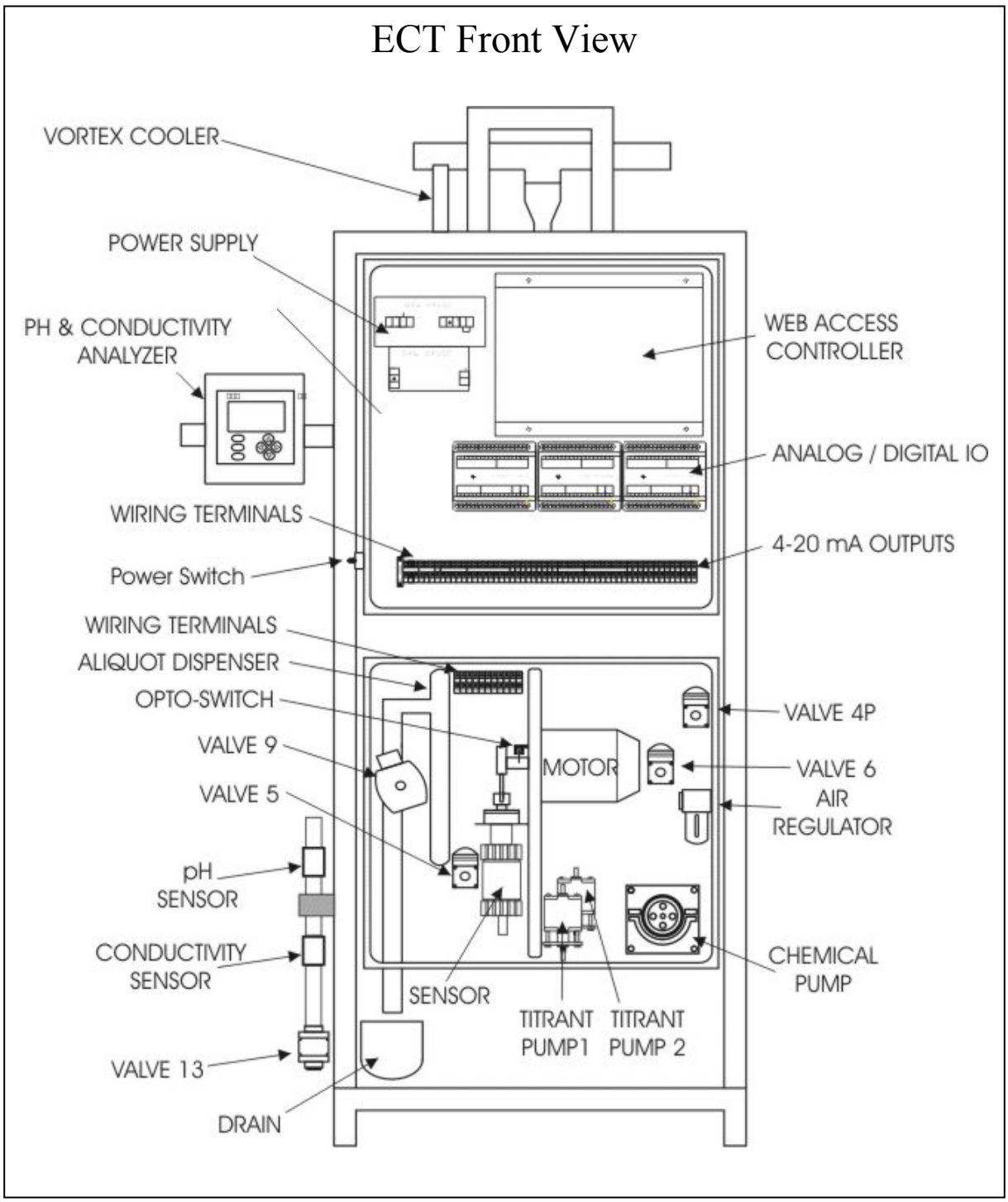

ECT Front View
VORTEX COOLER
POWER SUPPLY
PH & CONDUCTIVITY ANALYZER
WEB ACCESS CONTROLLER
ANALOG / DIGITAL IO
WIRING TERMINALS
4-20 mA OUTPUTS
Power Switch
WIRING TERMINALS
ALIQUOT DISPENSER
OPTO-SWITCH
VALVE 4P
VALVE 9
MOTOR
VALVE 6
AIR REGULATOR
VALVE 5
pH SENSOR
CONDUCTIVITY SENSOR
CHEMICAL PUMP
SENSOR
TITRANT PUMP1
TITRANT PUMP 2
VALVE 13
DRAIN

FIGURE 3

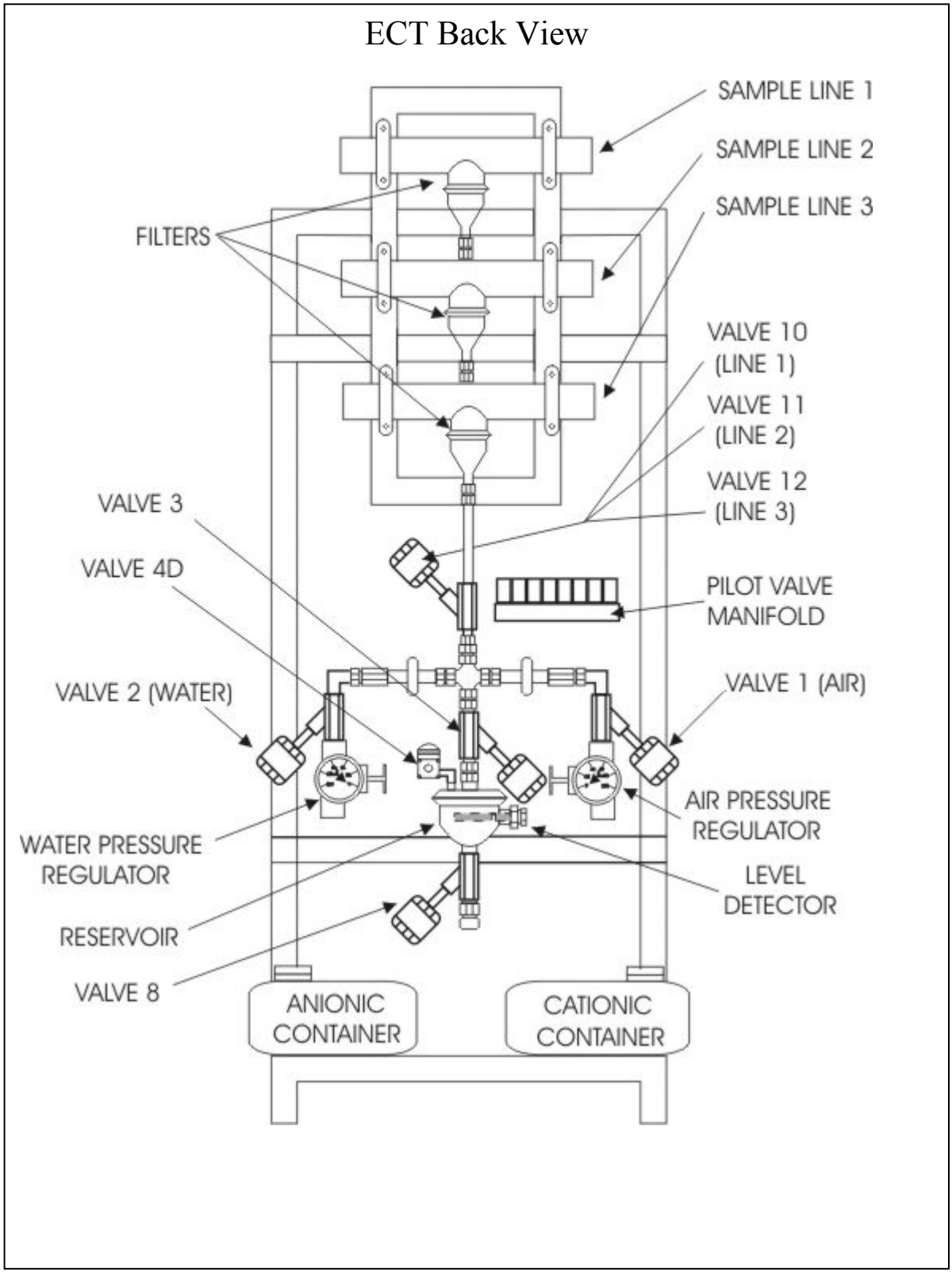
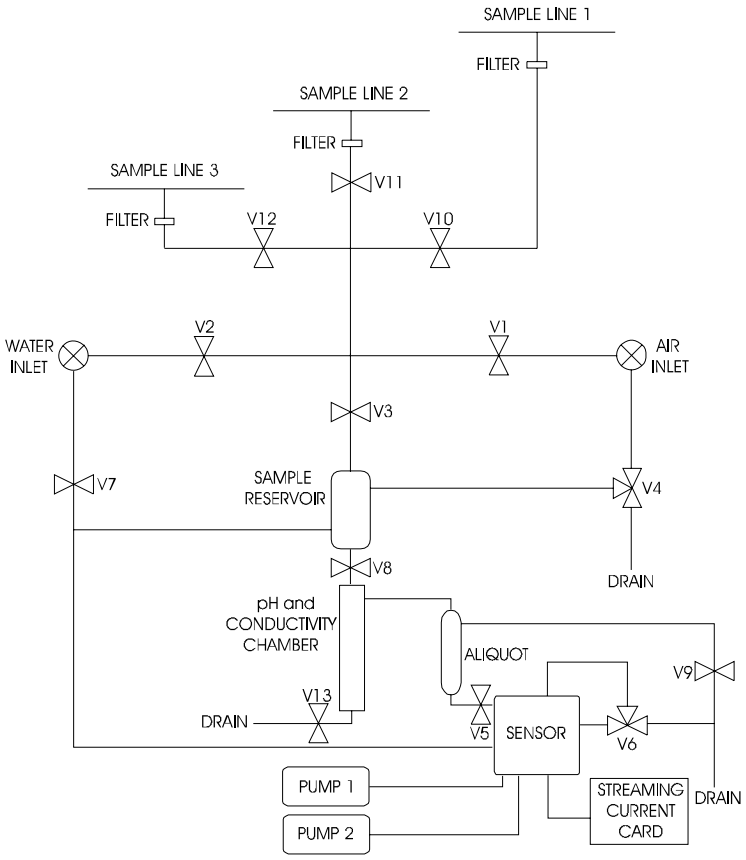

ECT Back View
SAMPLE LINE 1
SAMPLE LINE 2
SAMPLE LINE 3
FILTERS
VALVE 10
(LINE 1)
VALVE 11
(LINE 2)
VALVE 12
(LINE 3)
VALVE 3
VALVE 4D
PILOT VALVE
MANIFOLD
VALVE 2 (WATER)
VALVE 1 (AIR)
AIR PRESSURE
REGULATOR
WATER PRESSURE
REGULATOR
LEVEL
DETECTOR
RESERVOIR
VALVE 8
ANIONIC
CONTAINER
CATIONIC
CONTAINER

Figure 4 represents the ECT's hardware in schematic form, allowing the operator to view the movement of the sample, air, and water through the system. This schematic is shown again in Section 4.2 as each operation mode of the ECT is explained.

FIGURE 4

System Schematic



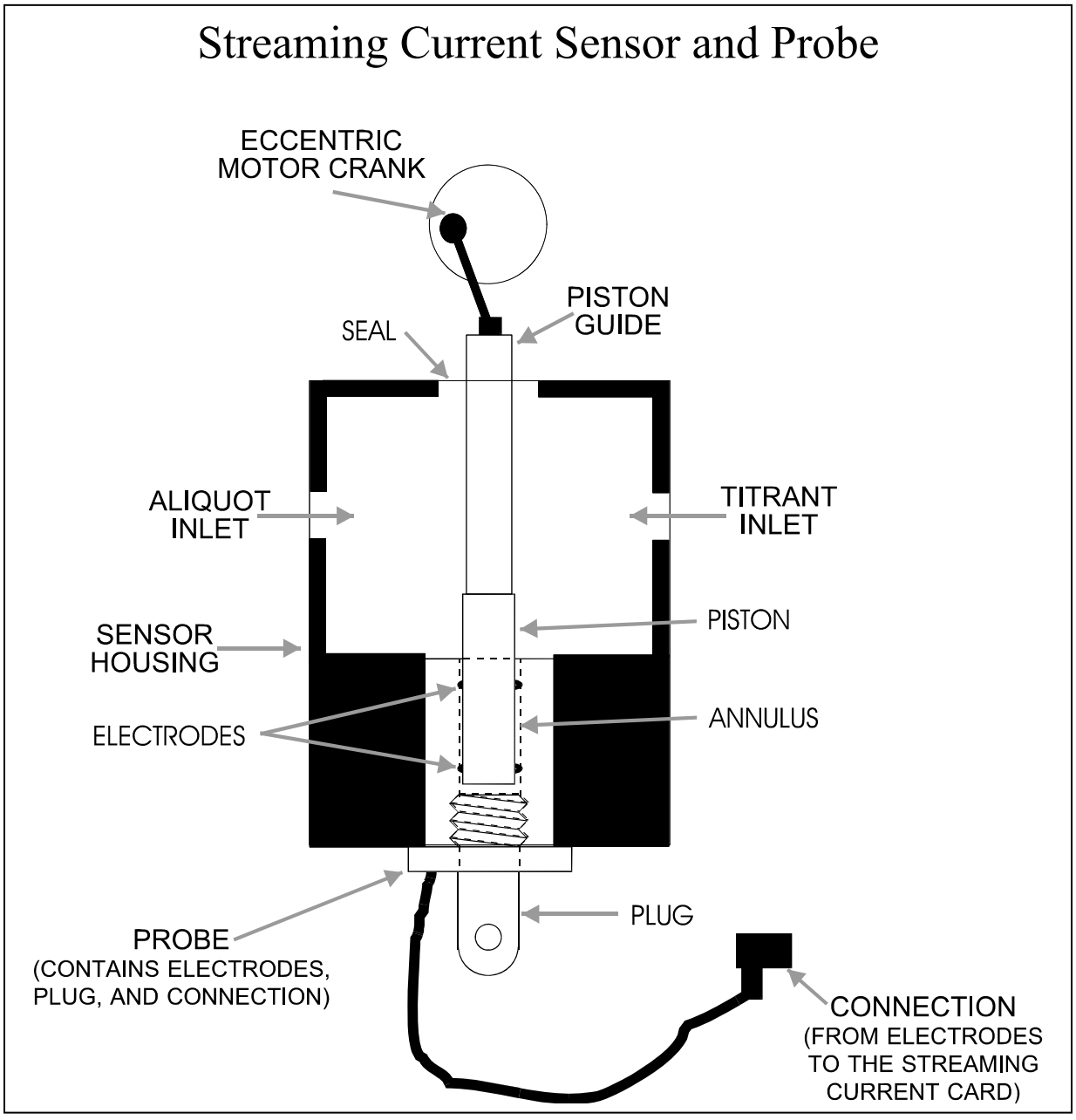
System Valves

V1: Air
V2: Water
V3: Drainage from Filter – Reservoir Inlet
V4: Vent Sample Reservoir (4D)/Pressurize Sample Reservoir (4P)
V5: Fill Sensor
V6: Drain Sensor/Vent Sensor
V7: Rinse Sensor and Level Detector
V8: Fill Aliquot Dispenser – Reservoir Outlet
V9: Aliquot over flow
V10: Selects Sample Line 1
V11: Selects Sample Line 2
V12: Selects Sample Line 3
V13: Drain pH/conductivity chamber (Optional)

2.3 SENSOR AND PROBE

The sample to be analyzed flows into the sensor, which is the housing for the probe. The probe contains the electrodes measure the STREAMING CURRENT. A simplified picture of this assembly is presented in Figure 5. Inside the probe is a small piston that reciprocates vertically. Above the piston, the piston rod is attached to an eccentric point on a crank driven by a motor outside the sensor. The piston's velocity is thus sinusoidal in nature.

FIGURE 5



The piston moves up and down inside the probe that is closed at the bottom. The space between this piston and the probe is called the annulus, which is critical to the streaming current device. The annulus has the shape of a thin, cylindrical "shell," which contains sample fluid and particles. The clearance between the piston and probe wall is several thousandths of an inch. As the piston reciprocates, it acts as a pump: when moving downward, it forces sample out of the cylinder, upward through the annulus. Note that the annular clearance is large enough to allow most particles in a typical sample to pass in or out, but small enough to cause significant fluid velocity within this space. When the piston reverses direction, it pulls fluid downward into the increasing volume below. The constantly reciprocating piston creates turbulence that ensures adequate mixing and continuous renewal of sample, such that changes in particle characteristics can be monitored.

It may then be assumed that the surfaces of both the piston and cylinder become adsorbed with particles from the sample. These particles adhere to the piston and cylinder walls by Van der Waal's forces. As the reciprocating piston induces fluid motion the counter-ions of the double layer are sheared away from the colloidal particle.

Figure 5 shows where the electrodes are positioned. These are two metal rings inserted in upper and lower areas of the probe. If the piston is moving downward (the fluid motion is upward), and the attached particles are negatively charged (therefore, the outer charged layer is positive), then the electrical current is traveling from the lower to the upper electrode.

It should be clear that the STREAMING CURRENT VALUE is dependent on the fluid direction and velocity. The resulting signal is an alternating current, which is easily separated from constant background DC noise. The magnitude of the charge density determines the magnitude of the STREAMING CURRENT VALUE, and thus determines the amplitude (peak height) of the alternating current signal.

2.4 SIGNAL PROCESSING

The processing of this alternating current is another important aspect of the ECT. The current generated in the sensor is on the order of 10 μamps, therefore a sensitive amplifier must be used. The current generated at the sensor is directly proportional to the piston velocity, provided that the particle characteristics are not changing over this time frame. The circuitry must change this signal into a constant, readable value that is proportional to the amplitude of the original sensor output. This is accomplished by performing an accurate RMS measurement of the signal. Finally, the RMS signal is scaled to the –1000 to +1000 SCV scale.

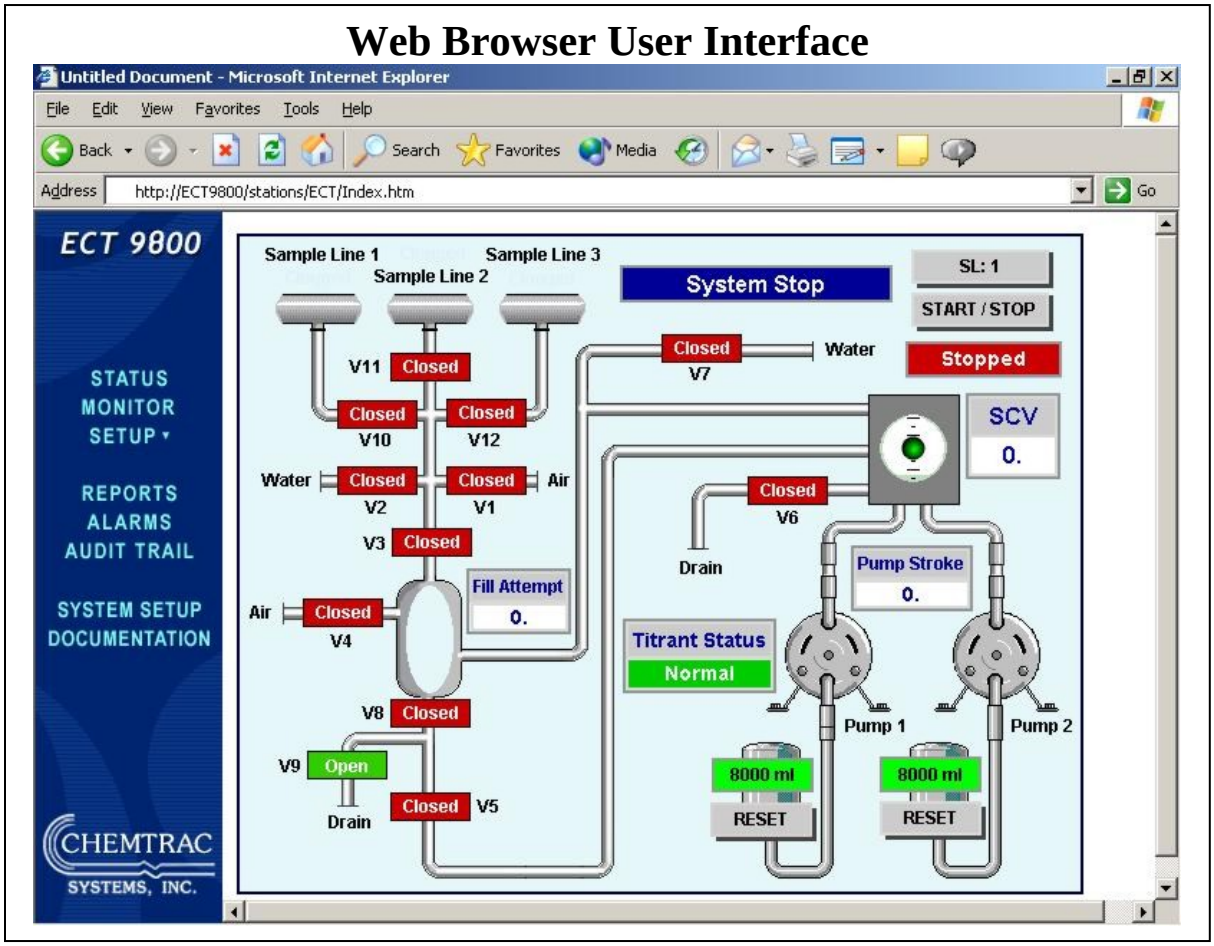
The value of this STREAMING CURRENT is relative. The instrument is not calibrated to be numerically equal to the actual current or charge density that exists in the sensor primarily because the calibration would be sensitive to small differences in the physical

dimension of the annulus and the chemistry of the sample (e.g. pH, Conductivity). Another reason the instrument is not calibrated to display a discrete charge value is that the instrument is sensitive to differences in charge distributions that vary from simple systems to complex systems. However, the unit includes a sensitivity adjustment that amplifies the original signal. Also, the ECT has a gain setting that allows the output to be varied by a factor of up to 20 times the primary signal.

2.5 ECT9800 USER INTERFACE

The Touch Screen Display, located on the upper enclosure of the ECT, is the primary user interface. By typing the name or IP address of the Web Access Controller (i.e. ECT9800 or 10.10.10.100) into the web browser (Internet Explorer) user interface screens as shown in Figure 6 can be accessed. These screens allow the user to start and stop the unit, change the ECT's parameters, and perform functions such as calibrating the titrant pumps.

FIGURE 6



2.6 WEB ACCESS CONTROLLER

The Web Access Controller controls all of the ECT valves and pumps. It also obtains the STREAMING CURRENT VALUE from the streaming current from the IO node, generates 4-20mA outputs, produces web page displays/readouts, and provides an 10 Base T, CAT 5 Ethernet connection. Operation of the controller is detailed in Section 4.1.

2.7 pH AND CONDUCTIVITY ANALYZERS

The pH and Conductivity analyzers are an available option on the ECT9800. The analyzers are calibrated by Chemtrac Systems and are ready to be used. Consult the manufacturer's manual for instructions on operation, calibration, and maintenance instructions.

3.0 INSTALLATION

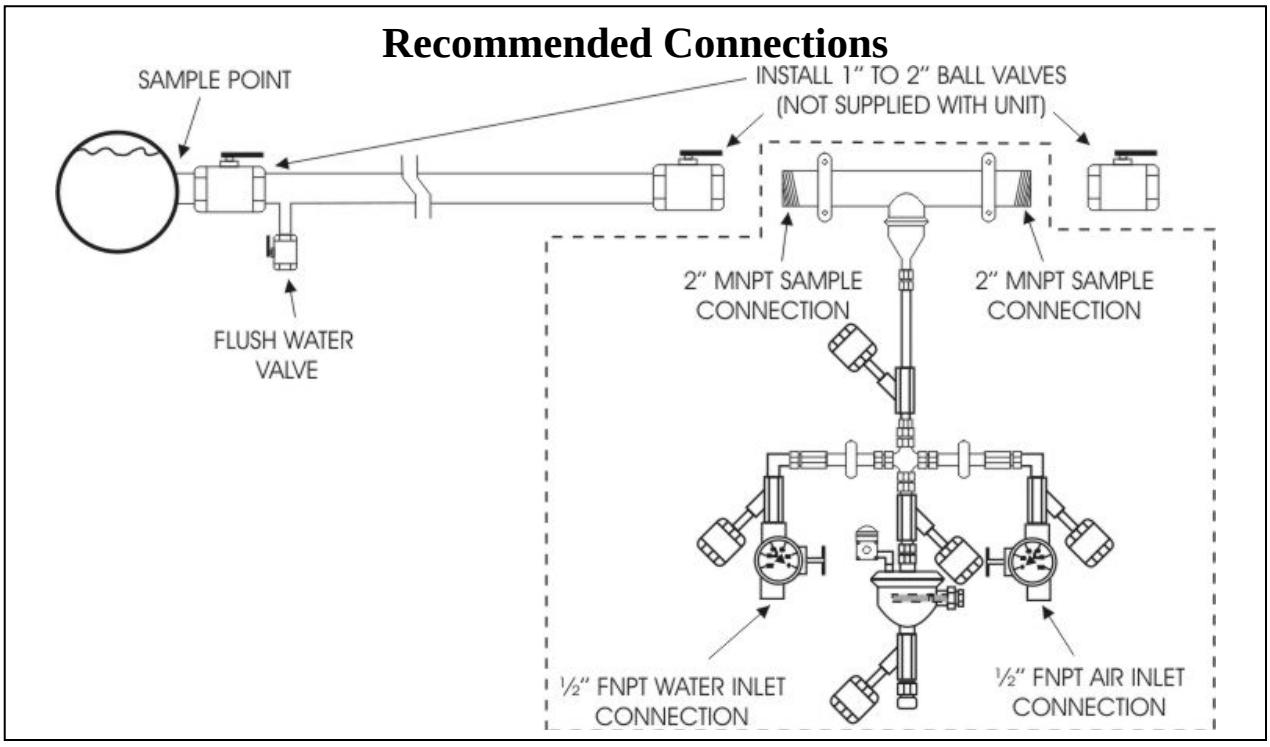
3.1 SAMPLE CONNECTIONS

Three furnish samples with a consistency of 4% or less can be delivered to the ECT (e.g. Blend Chest, Machine Chest, Headbox, etc..). The ECT is equipped with three sample lines with 2" MNPT fittings on the inlet and outlet of the ECT sample line. Manual service valves (2'' ball valves) must be installed on both the inlet and outlet of each sample line before connecting sample hoses / pipes. This will simplify maintenance by allowing the user to shut off sample flow to the ECT and also allows for adjusting flow rates and backpressure across the filtering assembly to optimize sample collection. Also, a water flush line (or connection for flush hose) installed at or near the sample point is recommended (see figure 7). This is recommended for thick stock samples to help clear the sample point or lines if they become plugged with fiber (which can happen during extended machine shutdowns).

At the sample point (e.g. Broke Chest), the tap should be 2'' ID and have a 2'' ball valve installed (thin stock samples can be smaller diameter, but no less than 1''). From the sample point to the ECT, either hard pipe or flexible tubing (2'' minimum diameter for thick stock) should be used for sample delivery. On the outlet of the each ECT sample line, install pipe or tubing to return stock to an appropriate point in the system (e.g. Machine Chest). It is not recommended to send stock to the sewer. To reduce or eliminate sample line plugging, avoid long runs (especially uphill) and sharp bends in the sample line when transporting thick stock samples. The ECT should be located as closely as possible to thickstock sampling/return points and sweeping bends should be used in piping.

During the sampling and flushing modes, a small amount of air and water are blown into the sample lines. The pressure and flow rate in the sample line does rapidly increase in short burst when air/water is blown through the filter and into the sample line. Therefore, all flexible tubing used to transport samples to and especially away from the ECT must be secured. A backflow preventer may be installed on the ECT Inlet to reduce pressure fluctuations (caused by the ECT flushing the filter with up to 40 psi of air & water) at the point of sampling. A backflow preventer is recommended on Headbox samples. Installation of backflow preventers is the responsibility of the mill.

FIGURE 7



3.2 AIR AND WATER CONNECTIONS

Connect clean, instrument-quality air to the air filter assembly (1/2" FNPT) shown in FIGURE 7 using a minimum ½'' ID piping or hose. The maximum pressure is 100 psi, and the minimum pressure required for proper operation of the ECT is 60 psi.

Connect clean, potable water to the filter/regulator (1/2" FNPT) as indicated in FIGURE 7 using a minimum ½'' ID piping or hose. The maximum pressure is 80 psi, and the minimum pressure is 30 psi.

The system drain is located underneath the bottom enclosure. A 1" hose barb connection is provided for the drain. The flow rate is less than 10 Gal/hr.

FIGURE 9

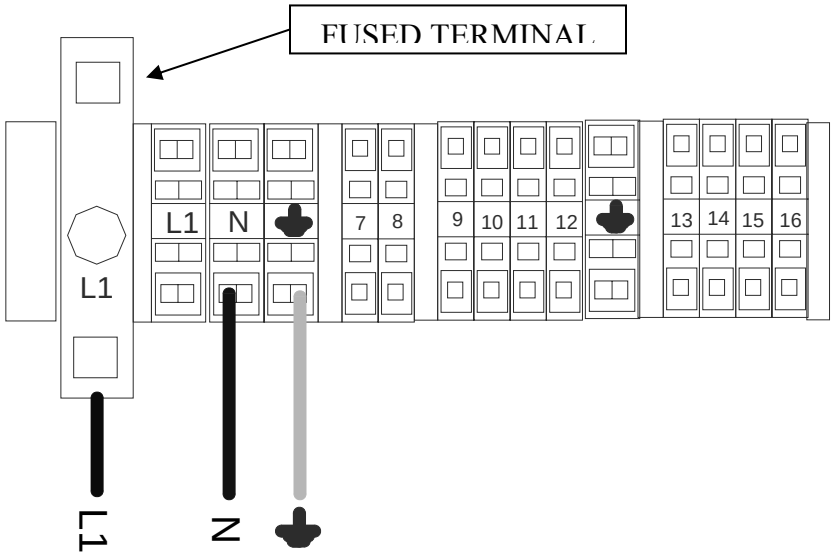


FIGURE 10

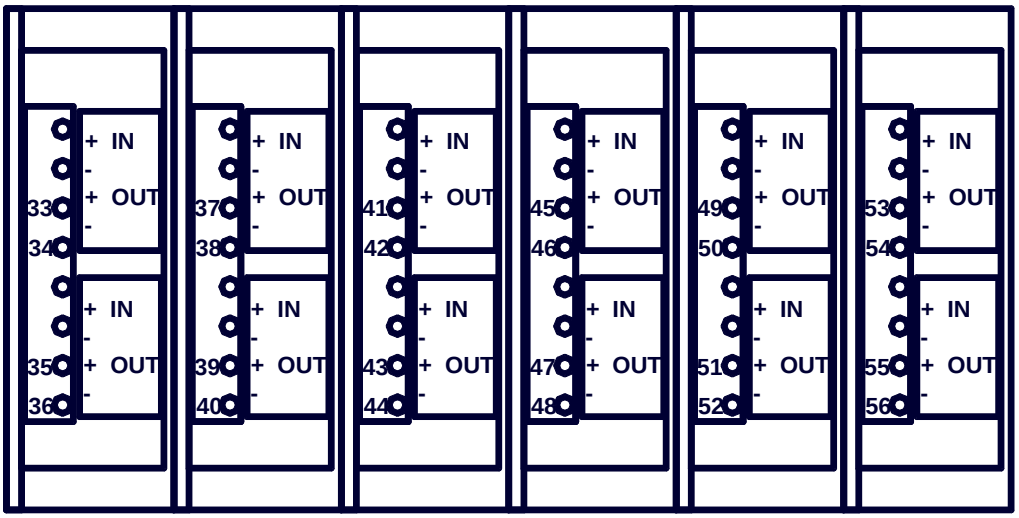


Figure 10 shows the 4-20mA Output Isolators which are located in the upper enclosure, bottom right hand corner. The table on the following page list the outputs and corresponding terminal numbers. The odd terminals are the + 4 to 20 mA signal, and the even terminals are the – 4 to 20 mA signal.

33, 34	**Sample Line #1 PH**
35, 36	**Sample Line #1 CONDUCTIVITY (uS)**
37,38	**Sample Line #2 PH**
39, 40	**Sample Line #2 CONDUCTIVITY (uS)**
41, 42	**Sample Line #3 PH**
43, 44	**Sample Line #3 CONDUCTIVITY (uS)**
45, 46	**Sample Line #1 CHARGE (SCV)**
47, 48	**Sample Line #1 DEMAND (ueq)**
49, 50	**Sample Line #2 CHARGE (SCV)**
51, 52	**Sample Line #2 DEMAND (ueq)**
53, 54	**Sample Line #3 CHARGE (SCV)**
55, 56	**Sample Line #3 DEMAND (ueq)**

NOTE: The PH and Conductivity outputs are only active if those optional analyzers are installed on the unit.

3.3 ELECTRICAL CONNECTIONS (POWER & 4-20mA Outputs)

For safety and proper operation, a grounded, stable AC power source must be provided. If the line voltage is not stable, the ECT's output will be erratic. Follow the provisions in the National Electric Code (NEC) and local electrical safety codes when providing power to this or any other electrical device.

A standard receptacle power cord is installed on the unit. Terminals for power connections are located in the upper enclosure and are labeled: **L1**, **N**, and ⏚. Fuse for AC power is a GMA 250 VAC 5 amp. Ensure the input power **L1** is connected to the Fused Terminal as shown in figure 9.

All internal electrical connections are established during the manufacturing of the ECT. Therefore, the operator does not need to make any adjustments. However, if 4-20mA outputs are desired, the terminals are labeled in FIGURE 10 for sample lines 1, 2 and 3. There are two outputs for each sample line, representing the stabilized STREAMING CURRENT VALUE (Charge) and CHARGE DEMAND. There is an additional output per sample line for each analyzer that is added. If both PH and Conductivity are installed on the ECT, there will be a total of twelve 4-20 mA outputs (i.e. Charge, Charge Demand, PH, & Conductivity outputs for each of the three sample lines). Current outputs are internally sourced and isolated with a maximum load of 250Ω.

3.4 COMMUNICATIONS

The ECT9800 is equipped with a Web Access Controller (WAC). The WAC is an imbedded PC with Windows NT operating system running a software that allows the user to access and control the ECT's operation through web browser enabled graphics. The WAC is network ready; equipped with an Ethernet network interface card (10 Base T), and it uses Windows NT security.

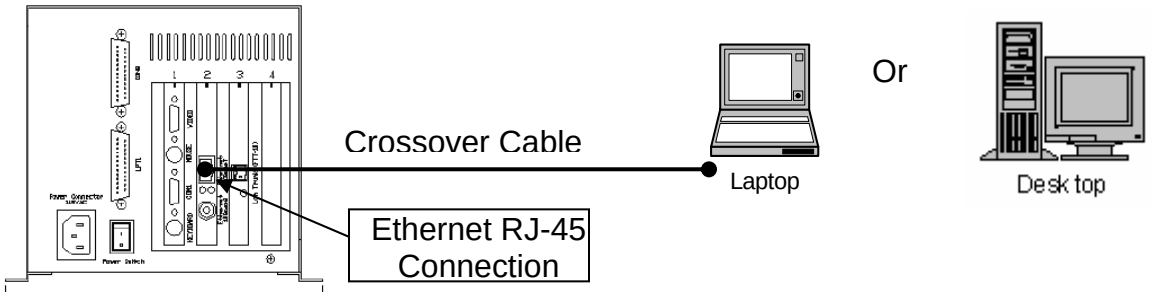
The WAC can also be accessed through a single computer (via Ethernet cable) or a Local Area Network computer. There is no special software required to interface to the WAC as it serves up information via standard Web pages. The only software requirement is a web browser such as Internet Explorer or Netscape Navigator. Figures 11 through 14 show the different options for setting up communications to the WAC (figure 12 shows how the communications are set up from the factory).

3.4.1 CONNECTION TO STAND ALONE COMPUTER

An Ethernet network interface card (10 Base T, with RJ-45 jack for Cat 5 network cable) is required on the laptop or desktop computer. The WAC is equipped with an Ethernet connection as shown in Figure 11. Crossover Ethernet (not straight thru) cable must be used to direct connect the WAC and the computer.

FIGURE 11

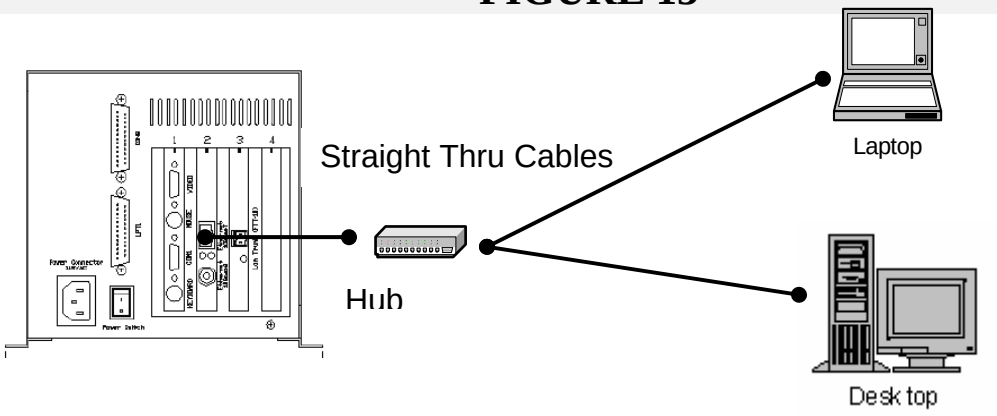
Direct connection between PC and the WAC using a Crossover Cable.



3.4.2 CONNECTION TO STAND ALONE OR MULTIPLE COMPUTERS USING ETHERNET HUB

A network Hub can be used to connect multiple computers, and the Access Point, using Straight Thru Cat 5 cable.

FIGURE 13



The WAC is shipped with factory network settings. The network settings information is labeled on the enclosure. Configure your computer network settings as instructed bellow to enable communications with the WAC.

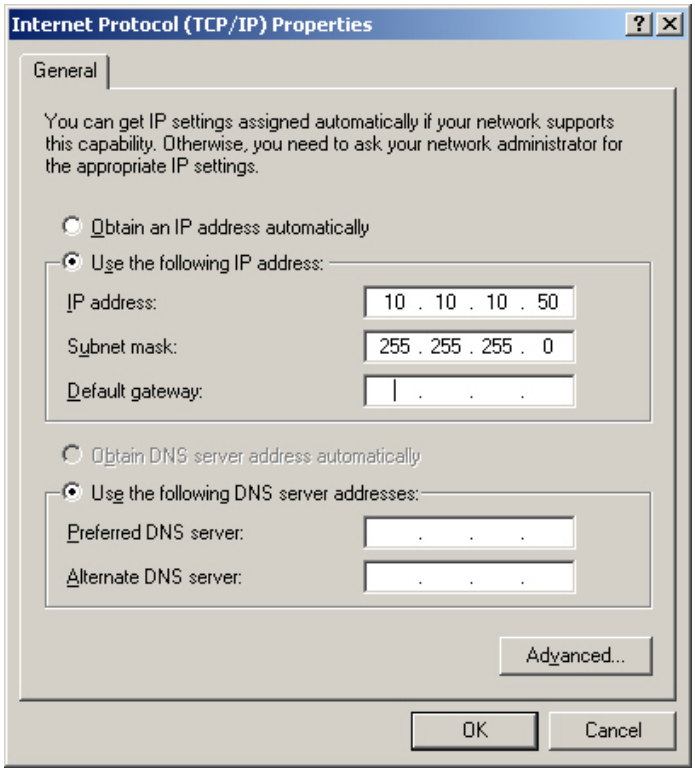
Computer Network Settings

1. To configure the laptop or desktop computer network settings, the following network setup must be performed. For Windows 95, Windows 98, Windows 2000 and Windows NT:
   - Go to: **START, SETTINGS, CONTROL PANEL, NETWORK.**
   - Under the **Configuration** tab check **TCP/IP** as the Network protocol and click on network properties.
   - Select **Specify an IP address**, type in the IP address, the IP address should be in the range specified in the static address pool entered for the W.A.C. The WAC IP address is indicated on its enclosure. You will also need to set the Subnet Mask to match the WAC settings: Here is an example of the WAC settings:

- WAC IP Address = 10.10.10.100
- Subnet Mask = 255.255.255.0
- Default Gateway = Blank

- **Do not** set the computers address for the following IP settings:
  - 10.10.10.100 (WAC IP address)
- An acceptable IP address for the computer would be anything between 10.10.10.10 to 10.10.10.90. Subnet Mask needs to be 255.255.255.0.

FIGURE 14


Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
10 . 10 . 10 . 50
Subnet mask:
255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

4.0 OPERATION

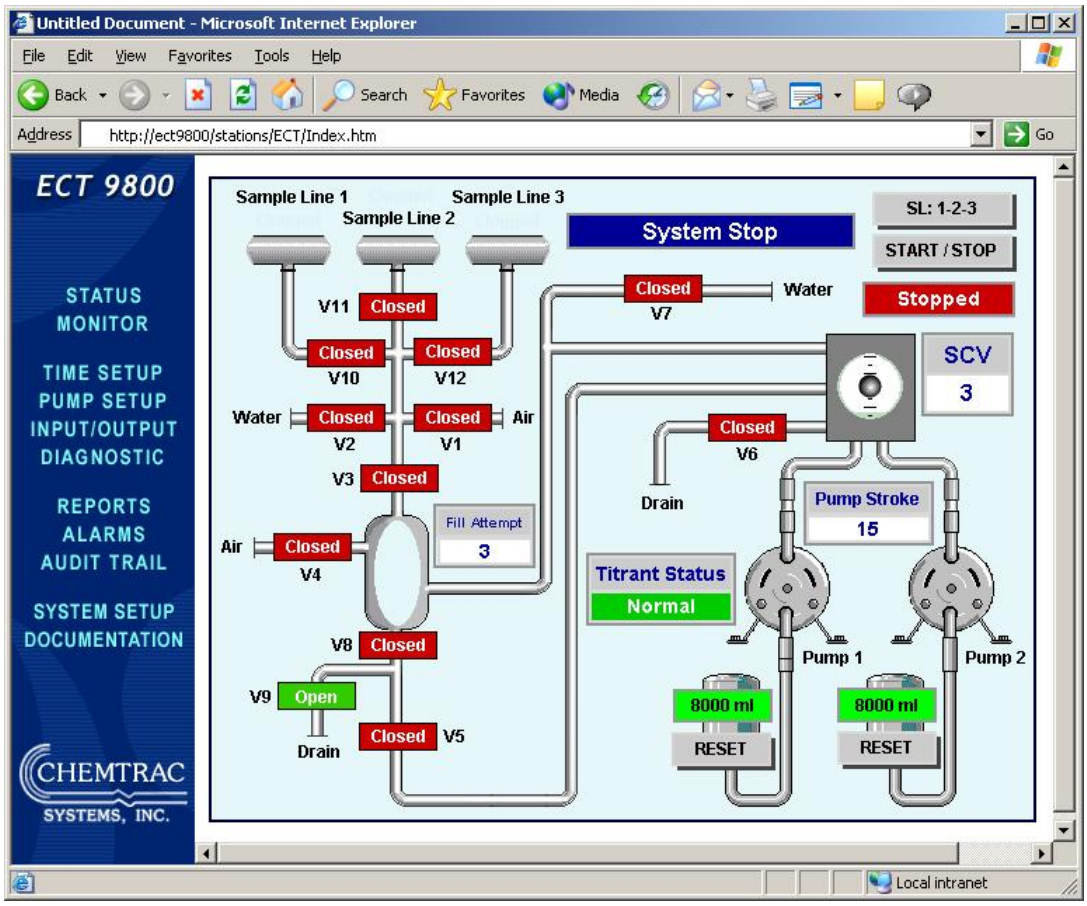
4.1 USING THE DISPLAY TO CONNECT TO THE ECT9800

Using the Touchscreen Display or a standalone PC (after you have properly configured your computer's IP configuration), open the web browser and type in "ECT9800" or "10.10.10.100" into the address bar. If the Touchscreen Display is on the Log In screen, simply press on ECT9800. A username and password screen will appear. The username and password that allow complete access to the ECT's controls are different for every installation and should have been given to the main customer contact during commissioning of the unit (contact Chemtrac if the security information is forgotten). For general access, a username of "ect" and a password of "9800" can be used (the username and password are case sensitive).

FIGURE 15

Once the correct username and password have been entered, the Status screen and the main left menu bar will appear.

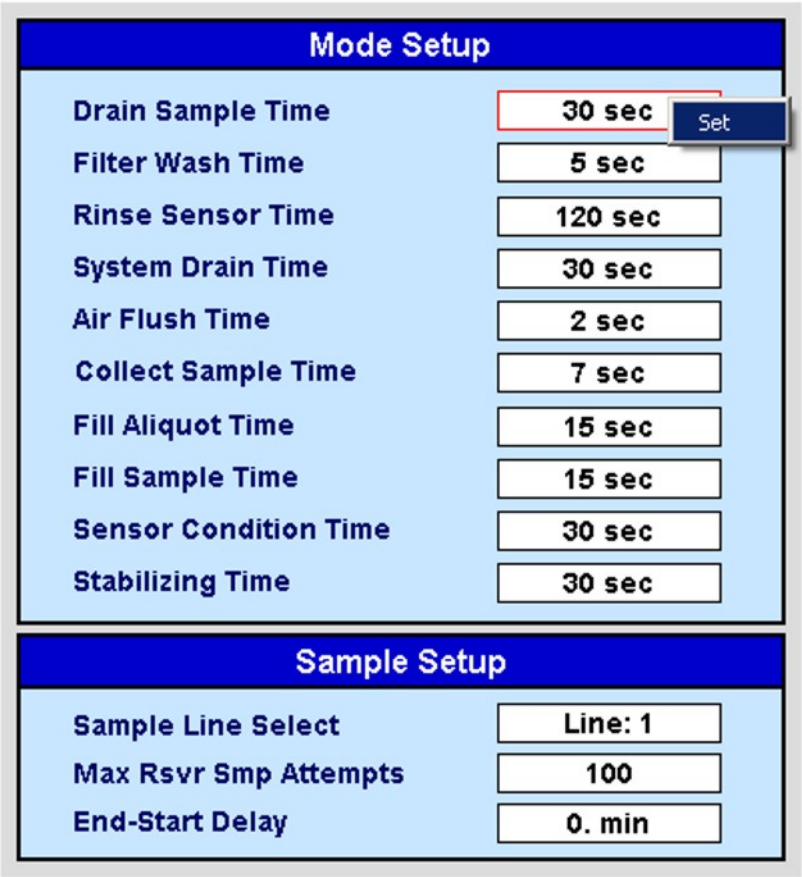
FIGURE 16



On the left menu bar, links to pages such as the Monitor page and the Pump Setup pages appear. Simply hold the mouse over any of these links and left click to see that page.

The Setup Screens are used to configure the ECT9800. The "Time" Screen allows the user to fine tune the ECT's operation and improve the speed at which it collects a sample, performs a titration, and updates the readings. In figure 17 you will see there are several parameters on the Time setup screen. Each parameter controls some function of the 14 different operating modes.

FIGURE 17

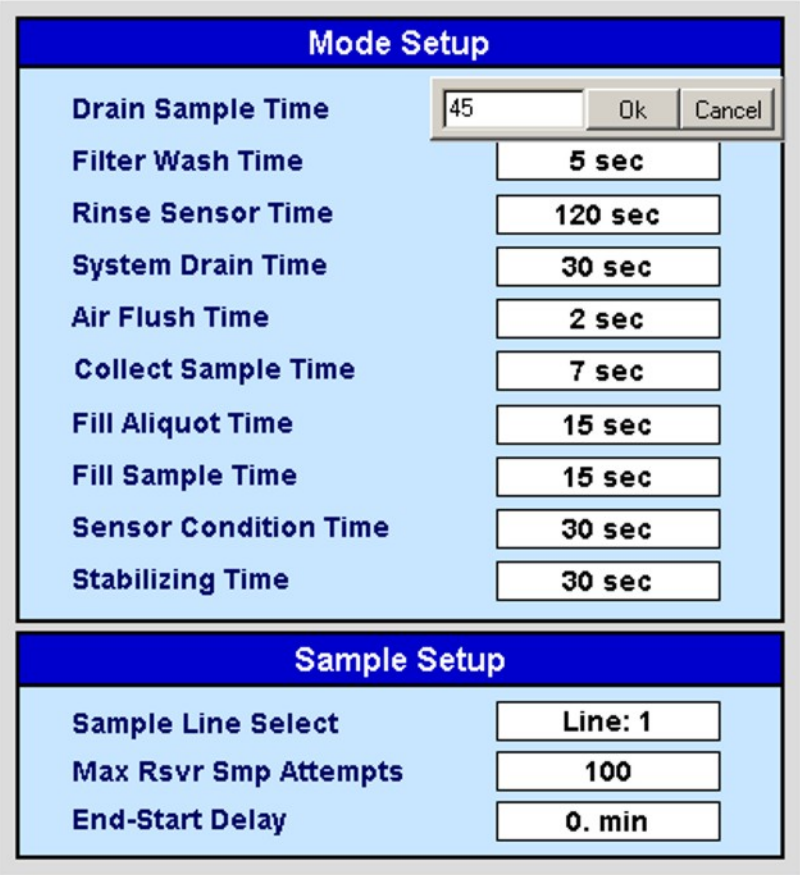


4.2 CHANGING SETTINGS ON THE ECT9800

Changing settings involves using the Right click function on your mouse (this function is accessible on the display by pressing on the lower right hand toolbar). Move the pointer over the setting you wish to change and Right click (Hint: a red outline will appear over the settings which can be changed by the user, you must right click to change the settings, not left click). After you have Right click on the setting, a message box, like the one shown in figure 17 where it says "SET" will appear.

The next step is to Left click on the message box (Left click, not Right click). Once this has been done another box will appear on the screen (see figure 18).

FIGURE 18



Simply type in the new setting into this prompt and Left click on the "OK" button to save the changes. If you do not wish to save the settings or make any changes, simply click on the "Cancel" button. Using the Mouse and the Right Click button is how the user first accesses and then makes changes to any settings on the ECT9800 interface screens. The important thing to remember is that links to different pages require the user to Left click and making changes to the settings require the user to first Right click.

4.2 STARTING AND STOPPING THE ECT9800

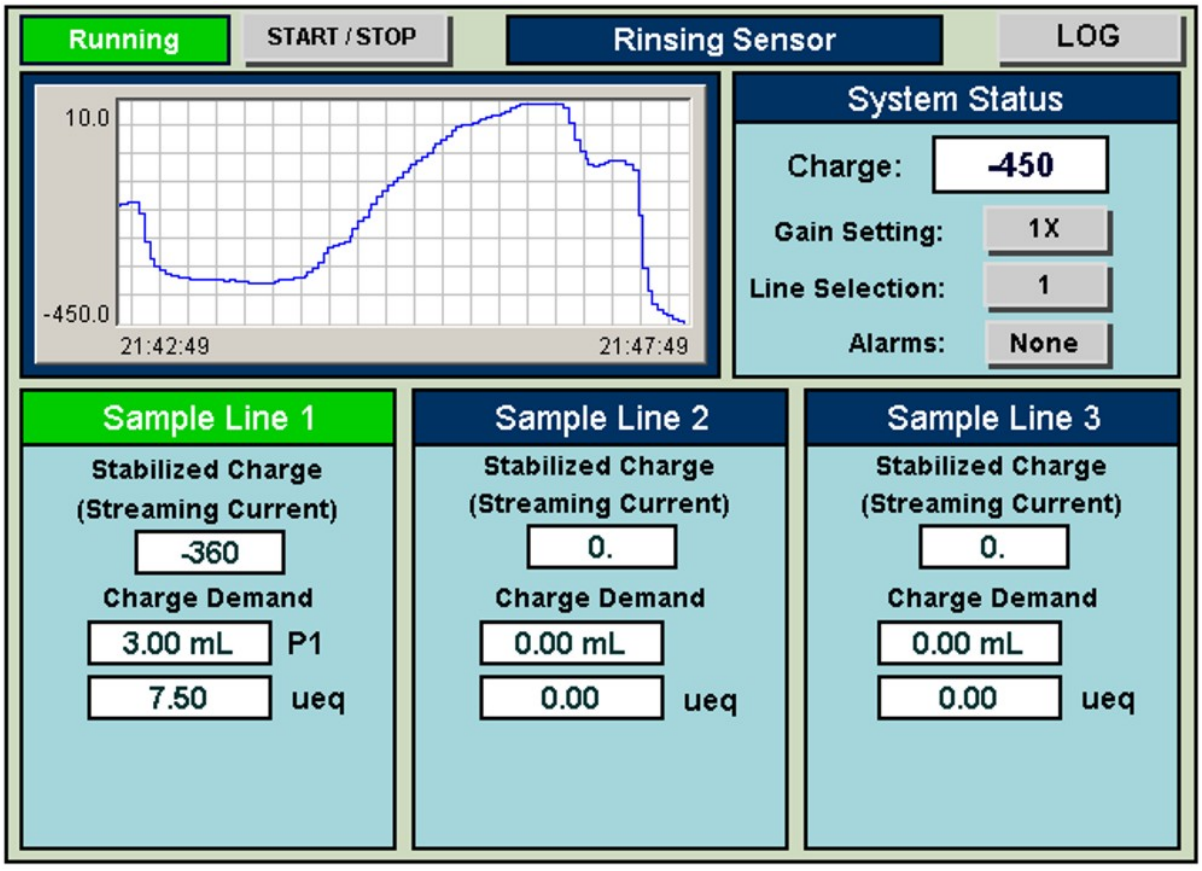
There is a master power switch on the exterior left side of the unit. If the ECT9800 needs to be stopped immediately, this switch should be set to the "OFF" position. To power the ECT9800 back up, simply turn the power switch back to the "ON" position.

NOTE: If the ECT is Running when the power switch is set to the Off position, the ECT will resume running when the unit is turned back on. It will take at least 2 to 3 minutes for the ECT to "Boot Up" after it has been turned off. During this Boot Up period, the user cannot access the web pages. So, if the unit was running when it was shut off and you wish

for it to not resume running when it is powered back up, it is recommended to shut off instrument air until the web pages can be accessed to properly shut off the ECT9800.

There are "**Start/Stop**" buttons on the Status and Monitor Screens. On the Monitor screen (as shown in figure 19), the Start/Stop button is located on the top left hand side of the screen. Right next to the Start/Stop button is an indicator of the state of the ECT. This indicator will either say Running or Stopped. To start the ECT, Right Click on the Start/Stop button, Left click on the Command button, and then select Start from the prompt and Left click on the OK button. To stop the ECT, use the same procedure, but select Stop from the prompt.

FIGURE 19



4.3 OPERATING MODES

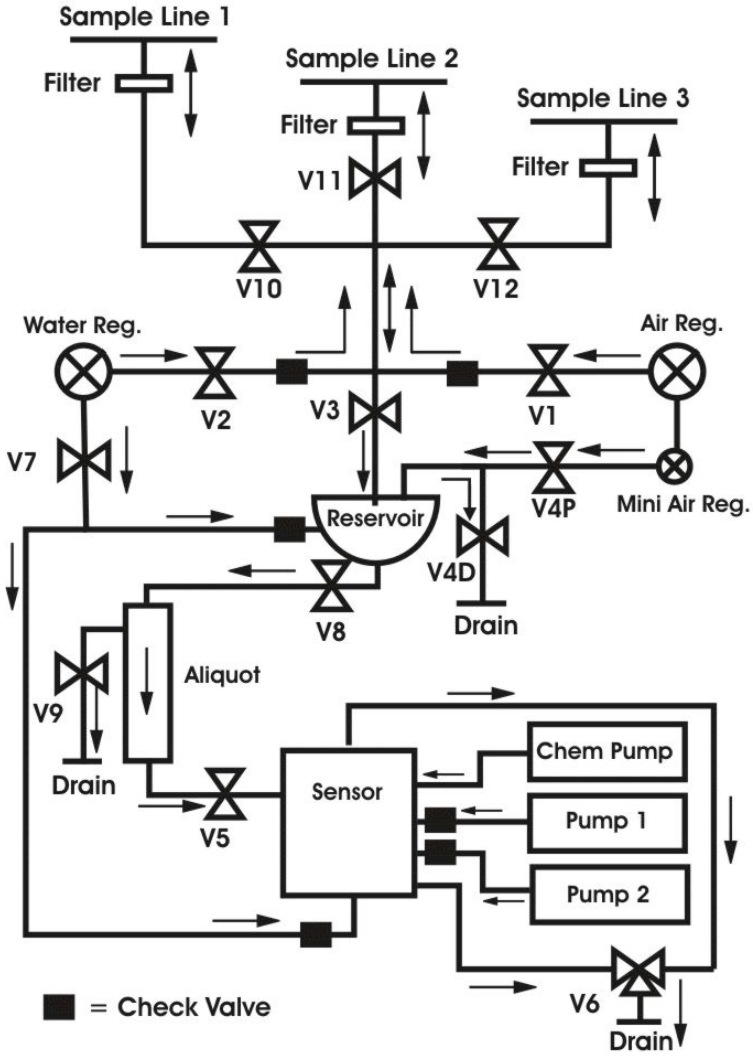
When Start is selected from the Start/Stop button, the unit will begin operation. Each operating mode will always occur in the order given in TABLE 1.

TABLE 1

OPERATING MODES	EXPLANATION OF OPERATION
1. DRAINING SAMPLE	Any extraneous liquid in the system is drained.
2. WASHING FILTER	Air and water are used to clean the filter.
3. SENSOR CHEMWASH	The sensor is washed with a chemical (i.e. bleach) and then rinsed with water.
4. DRAINING SYSTEM	Water from the rinsing mode is drained.
5. COLLECTING SMPL	The filter is flushed with air, then the filtrate drains into the reservoir. This is repeated until the level detector is activated.
6. FILLING ALIQUOT	Filtrate in the reservoir is delivered into the aliquot. Excess filtrate goes to drain.
7. FILLING SENSOR	The aliquot dispenses filtrate into the sensor.
8. CONDITIONING	The first sample taken is used to condition the sensor.
9. DRNNG CND SMPL	The conditioning sample is drained from the system.
10. COLLECTING SAMPL	The filter is flushed with air, then the filtrate drains into the reservoir. This is repeated until the level detector is activated.
11. FILLING ALIQUOT	Filtrate in the reservoir is delivered into the aliquot. Excess filtrate goes to drain.
12. FILLING SENSOR	The aliquot dispenses filtrate into the sensor.
13. STABILIZING	The system pauses to allow the sensor to obtain a stable reading before titration begins.
14. TITRATING	Depending on the operating parameters and SCV, the ECT delivers titrant from PUMP1 or 2 until the SCV equals zero.
OPERATIONAL DELAY	If an "end-start delay time" is entered, there will be a delay between line sampling.

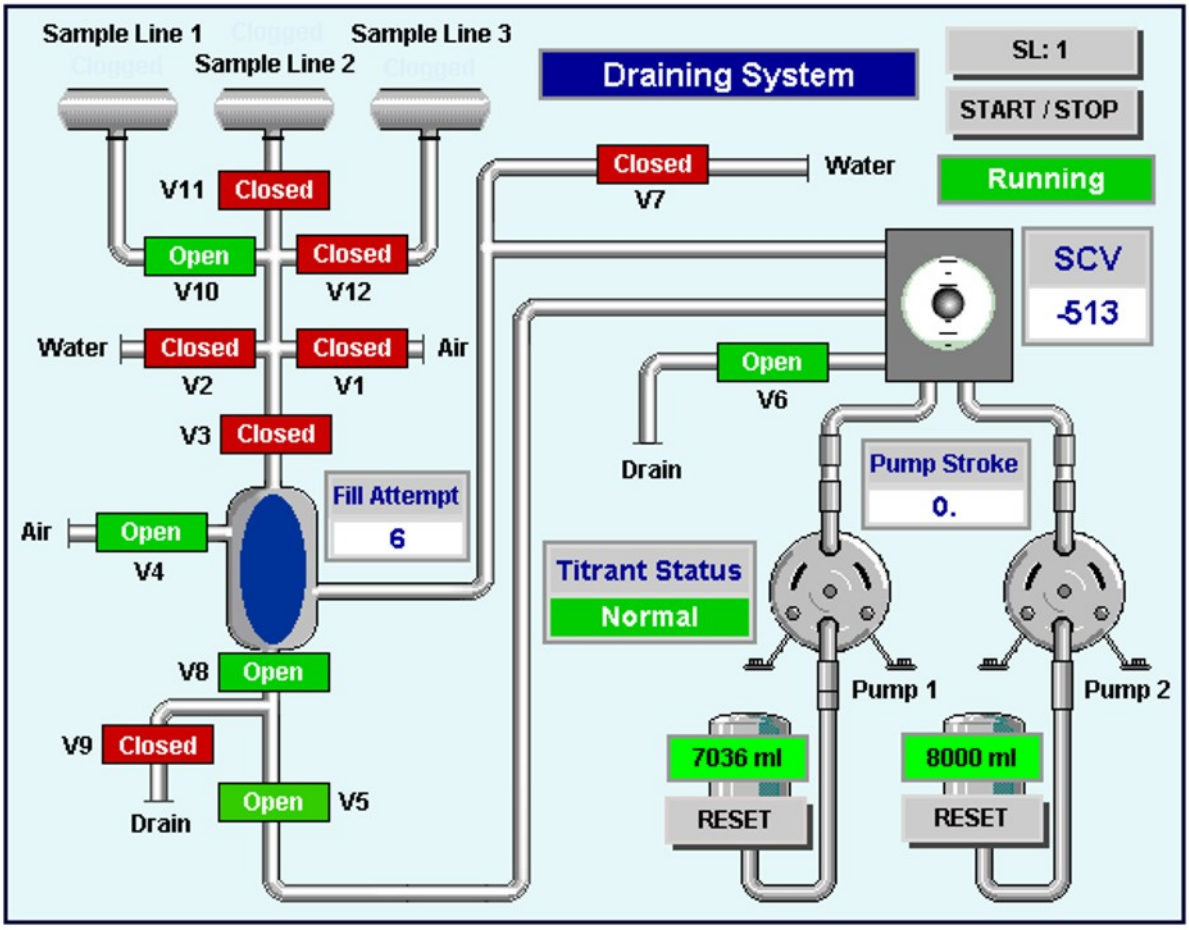
FIGURE 20

System Schematic

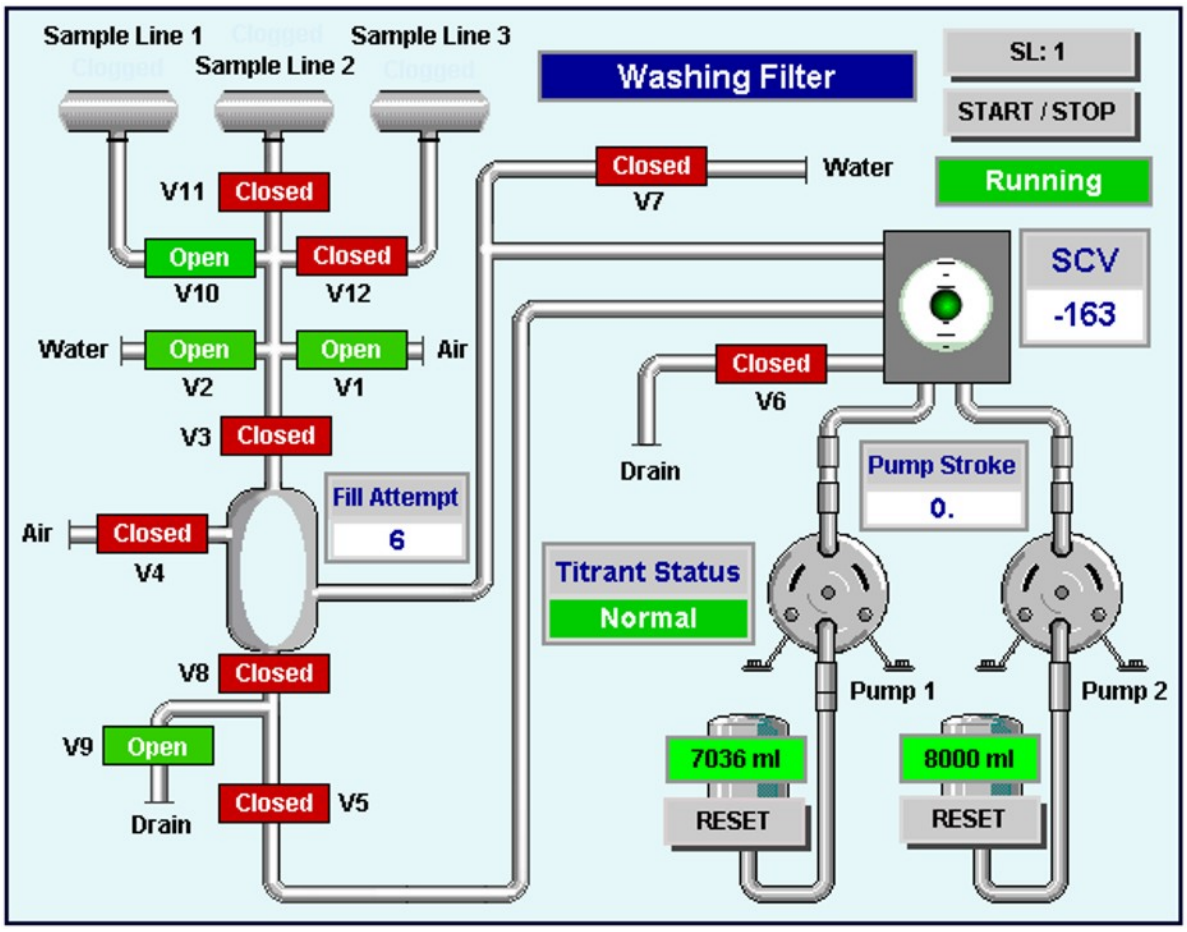


System Valves Function

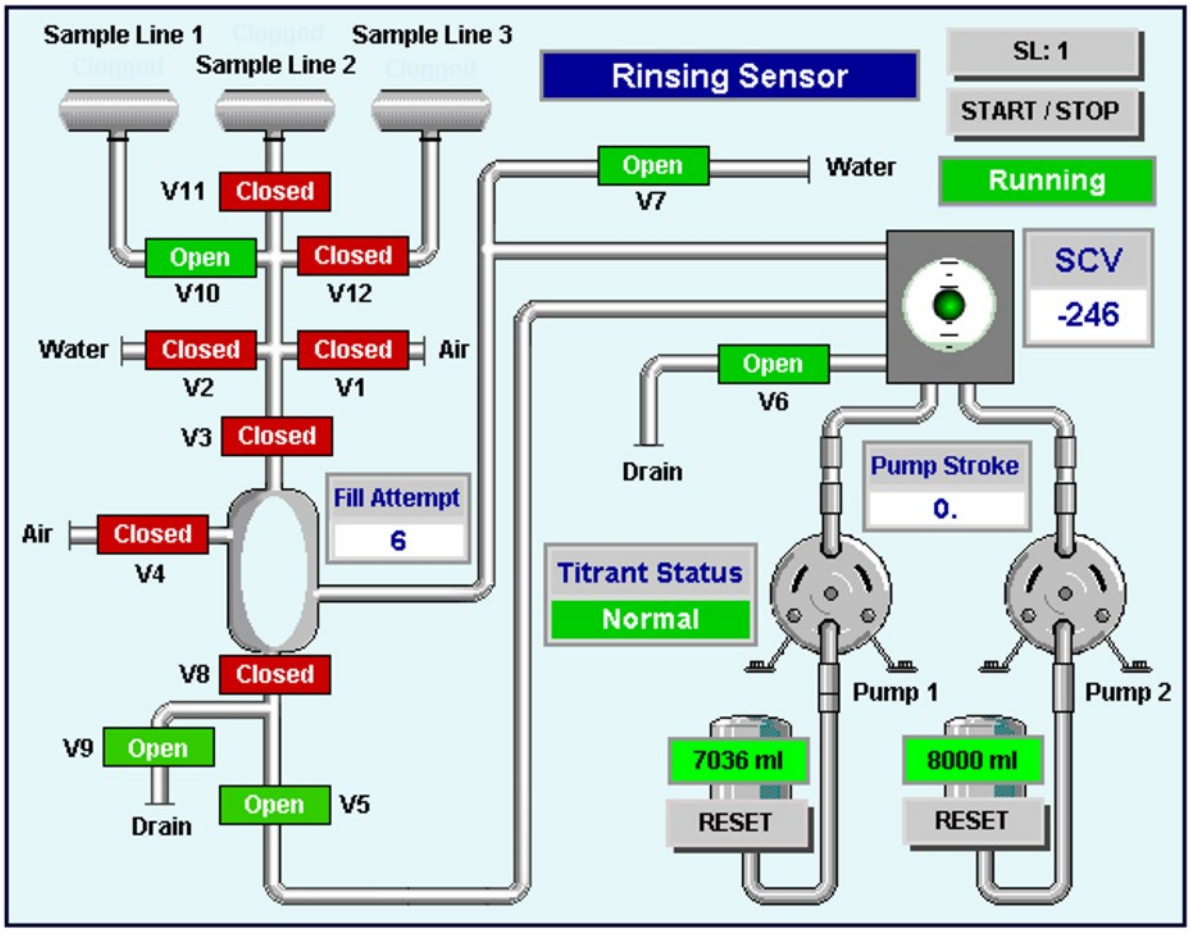
V1: Filter Air Purge
V2: Filter Water Purge
V3: Drainage from Filter (Filtrate)
V4P: Pressurize Sample Reservoir
V4D: Vent Sample Reservoir
V5: Fill Sensor
V6: Drain Sensor/Vent Sensor
V7: Rinse Sensor and Reservoir
V8: Fill Aliquot Dispenser
V9: Aliquot over flow
V10: Selects Sample Line 1
V11: Selects Sample Line 2
V12: Selects Sample Line 3



During this mode, Valve 4 opens, pressurizing the Sample Reservoir.
Valve 9 (normally open) closes. Valves 5, 6, 8 and 13 (PH/Conductivity option) open, draining the Aliquot Dispenser, Sensor, Sample Reservoir and pH/conductivity chamber.



During this mode, Valves 1 and 2 open to flush the active sample line filter with air and water.

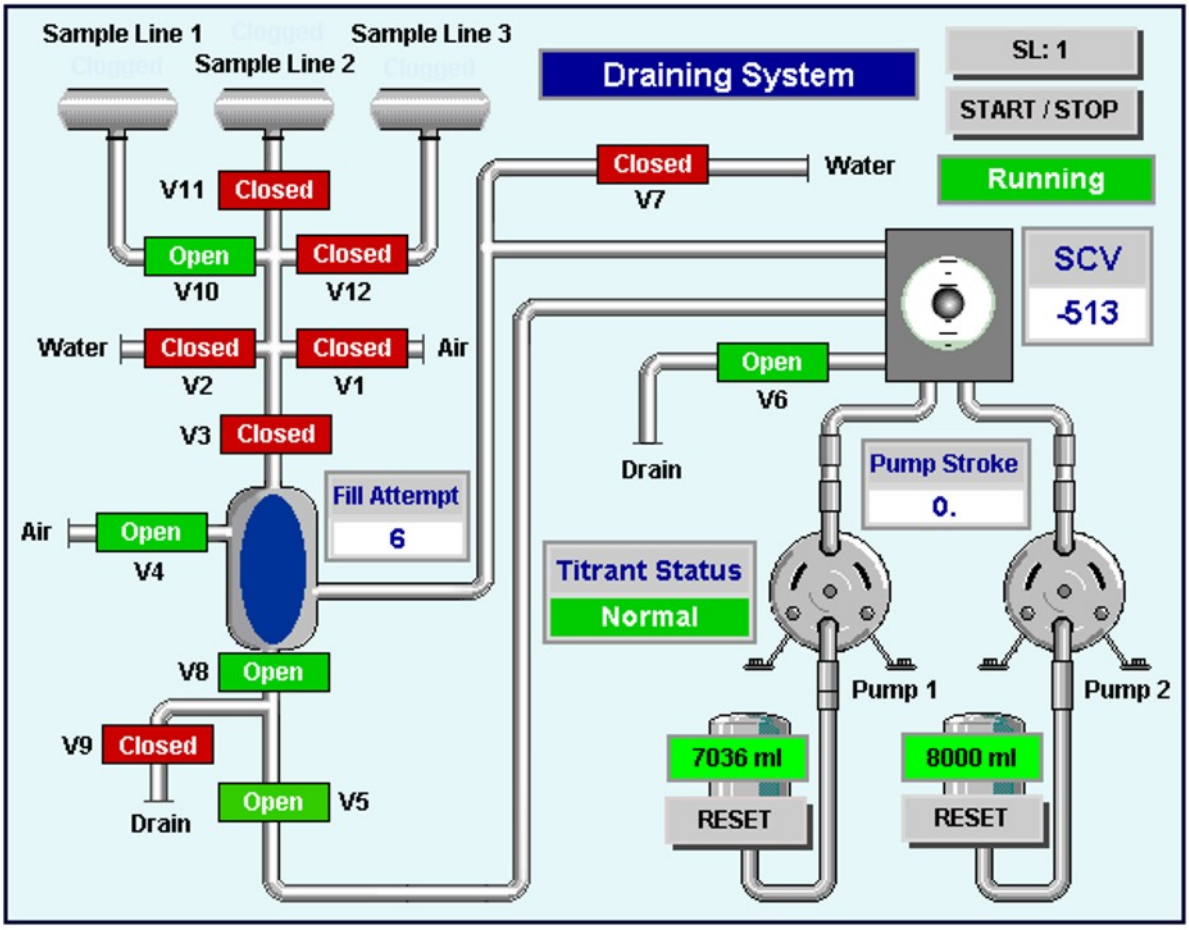


Valve 7 opens, flushing the Sensor, Reservoir and Level Detector with water.

Valve 5 opens, allowing the Aliquot Dispenser to be back flushed.

Valve 6 opens, allowing flush water from the Sensor to drain.

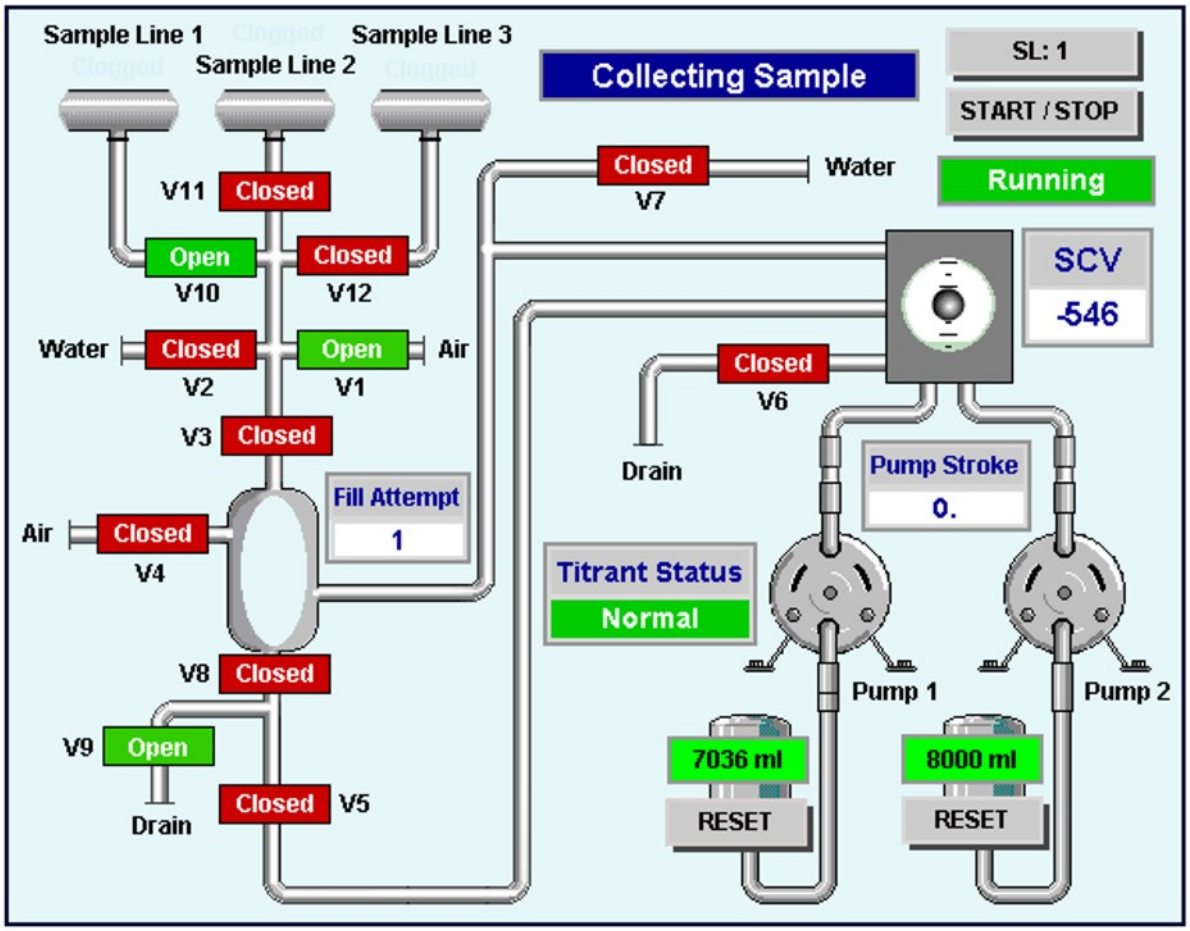
Valve 13 (PH/Conductivity option) opens, allowing the pH/conductivity chamber to drain.



Valve 4 opens, pressurizing the Sample Reservoir.

Valve 9 (normally open) closes.

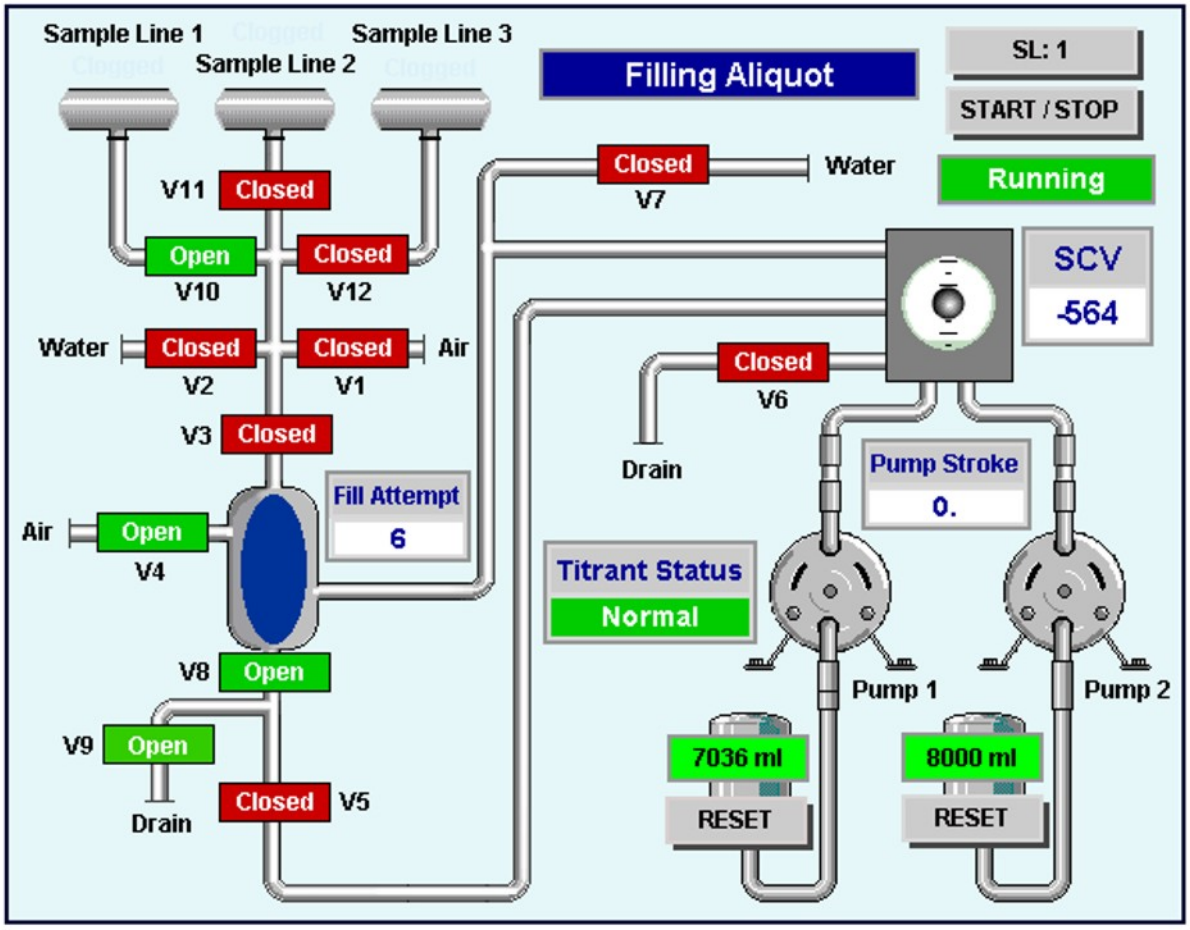
Valves 5, 6, 8 and 13 open, draining the Aliquot Dispenser, Sensor, Sample Reservoir and pH/conductivity chamber.



Valve 1 opens, forcing air through the filter.

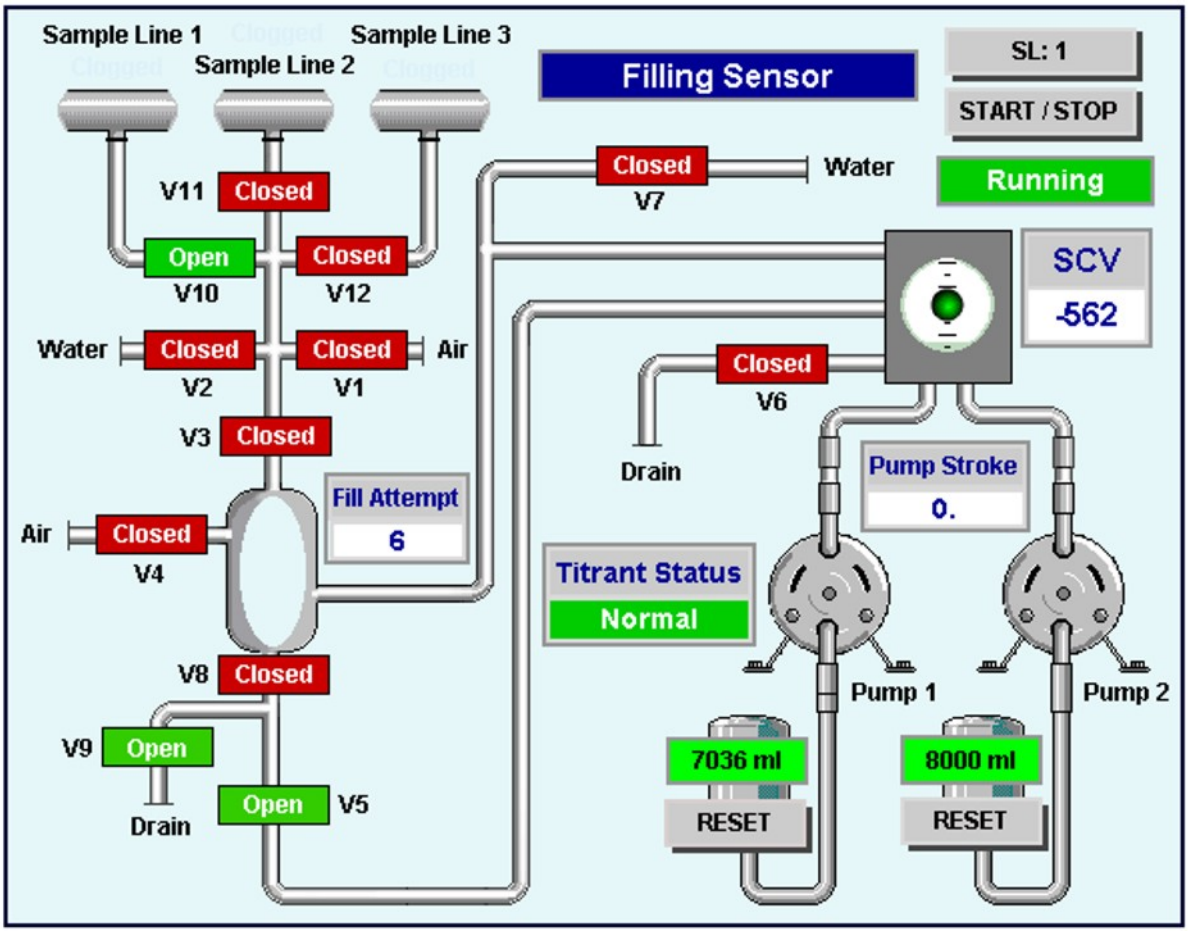
After Valve 1 closes, a short delay occurs before Valve 3 opens, which allows filtrate to drain into the Sample Reservoir.

This is repeated until the Level Detector is activated, which is indicated by the reservoir graphic turning blue. Notice that the "Fill Attempt" text box next to the reservoir keeps track of how many times Valve 3 has to open to collect a sample.

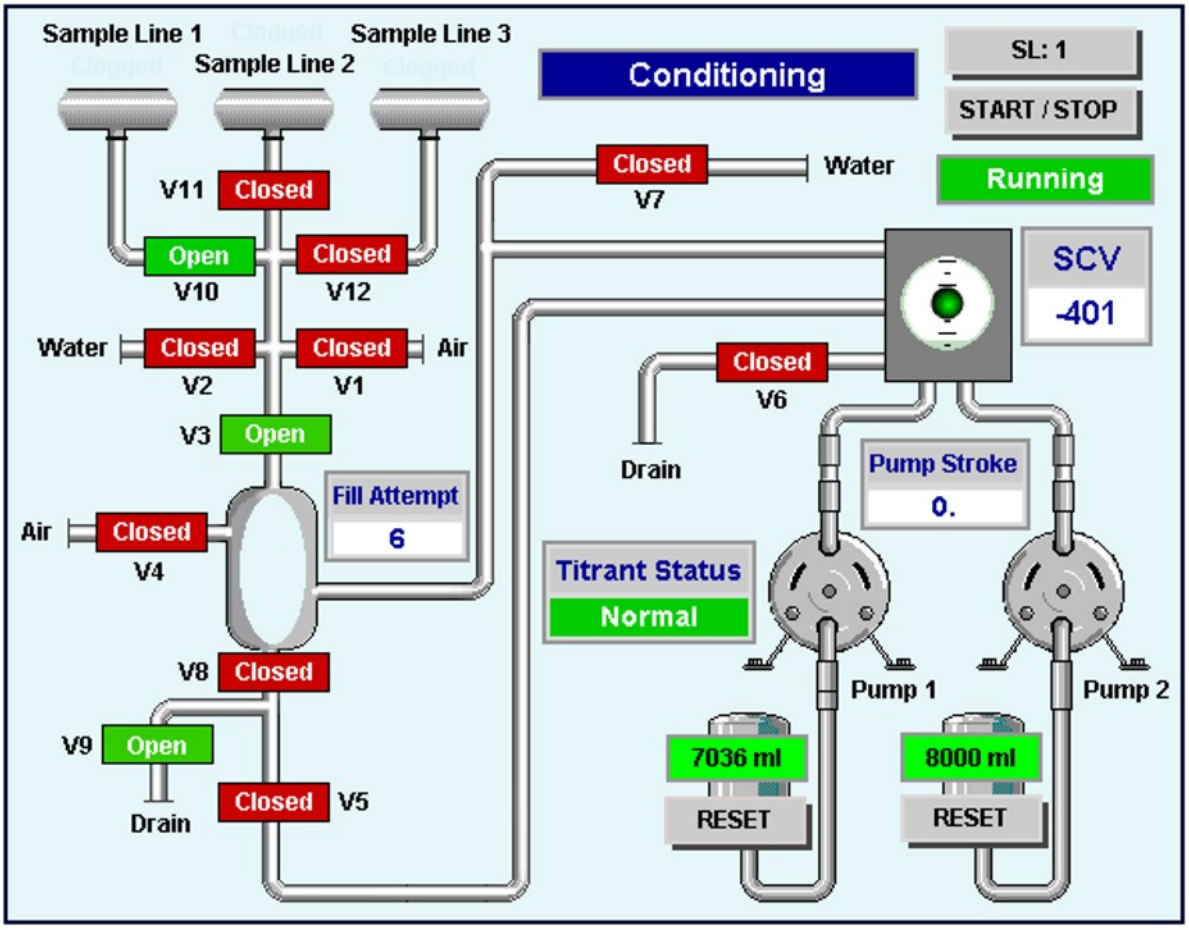


Valve 4 opens, pressurizing the Sample Reservoir.

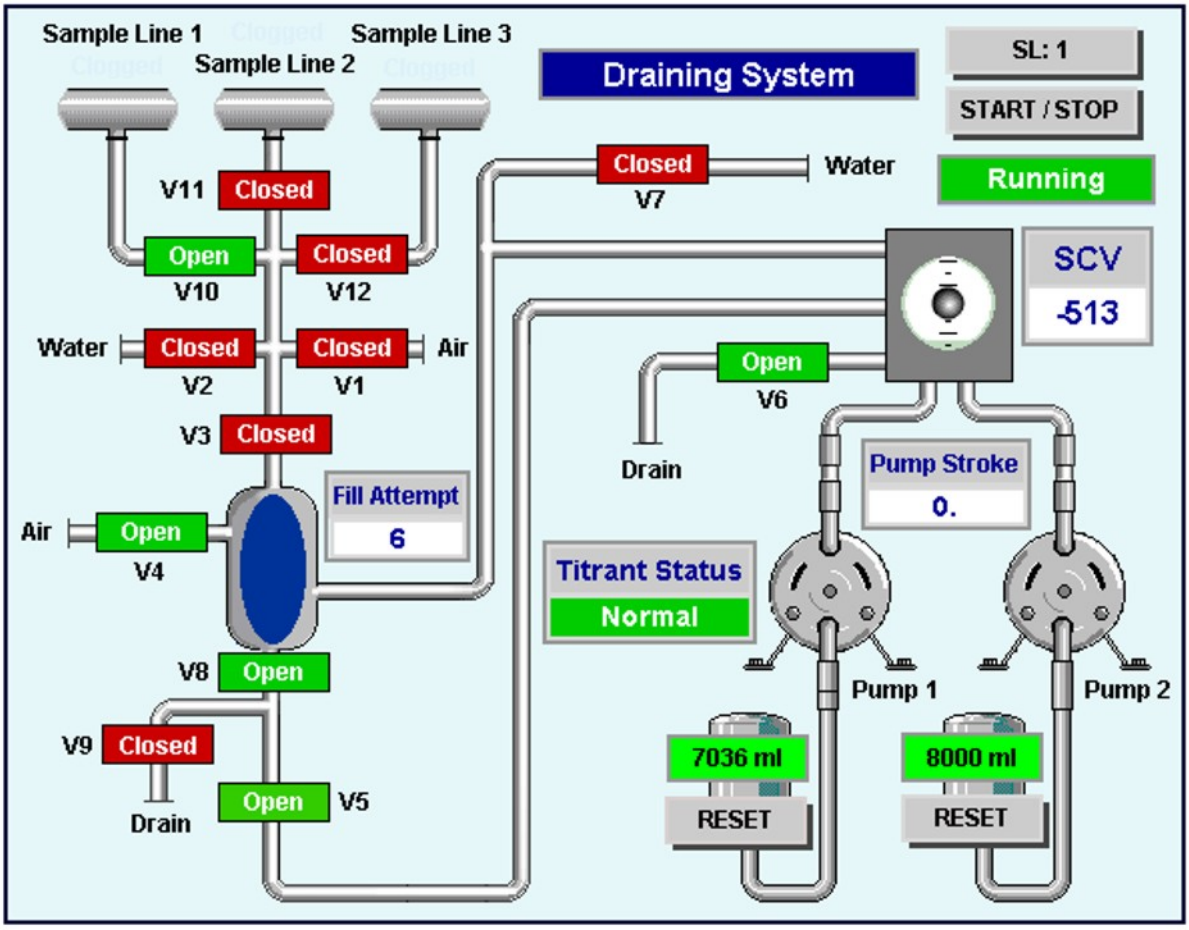
Valve 8 opens, allowing the filtrate in the Sample Reservoir to fill pH/conductivity chamber and the Aliquot. The excess goes to drain.



Valve 5 opens, emptying the contents of the Aliquot into the Sensor.

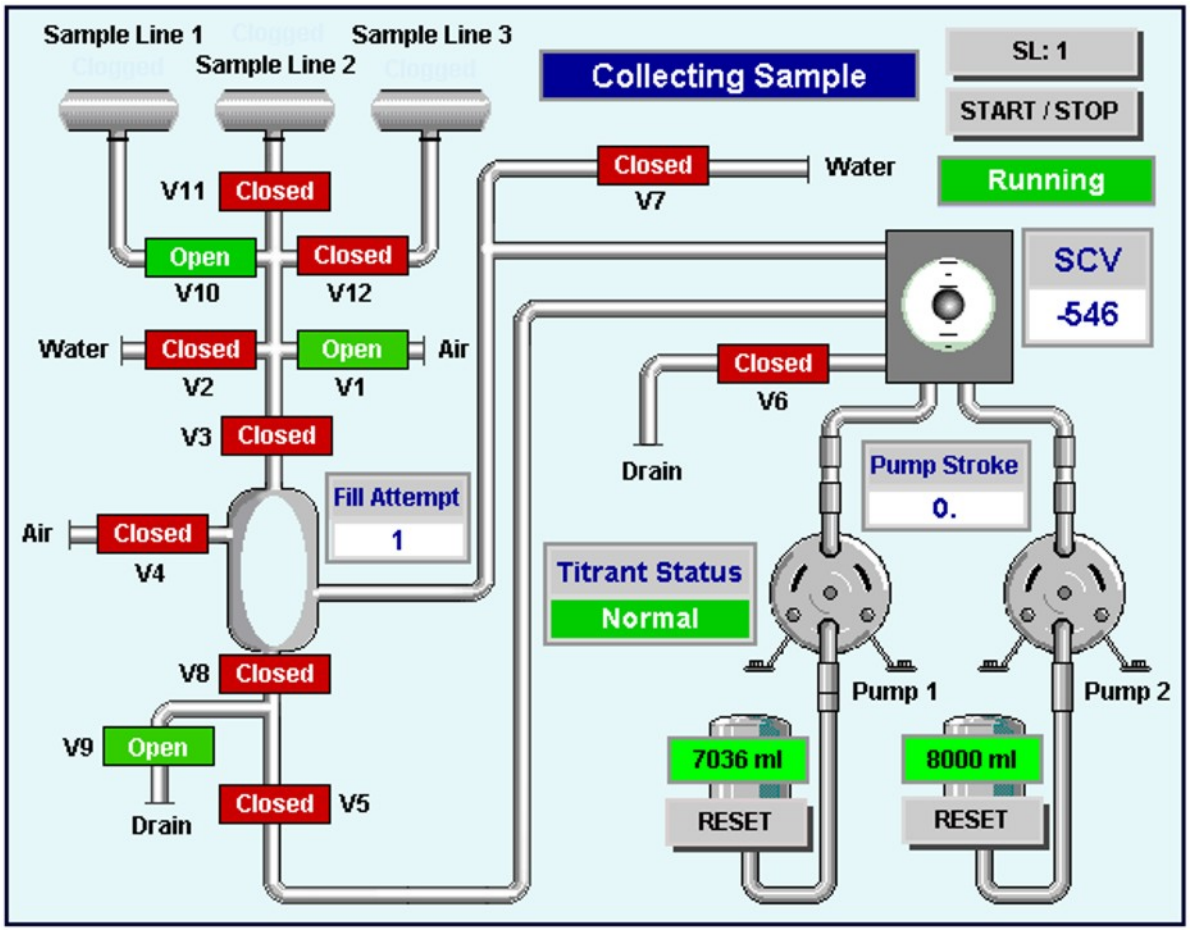


The first sample taken is used to condition the Sensor. While the sensor is being conditioned, Valves 1 and 3 are operating to collect more sample into the reservoir.



Valve 4 opens, pressurizing the Sample Reservoir.

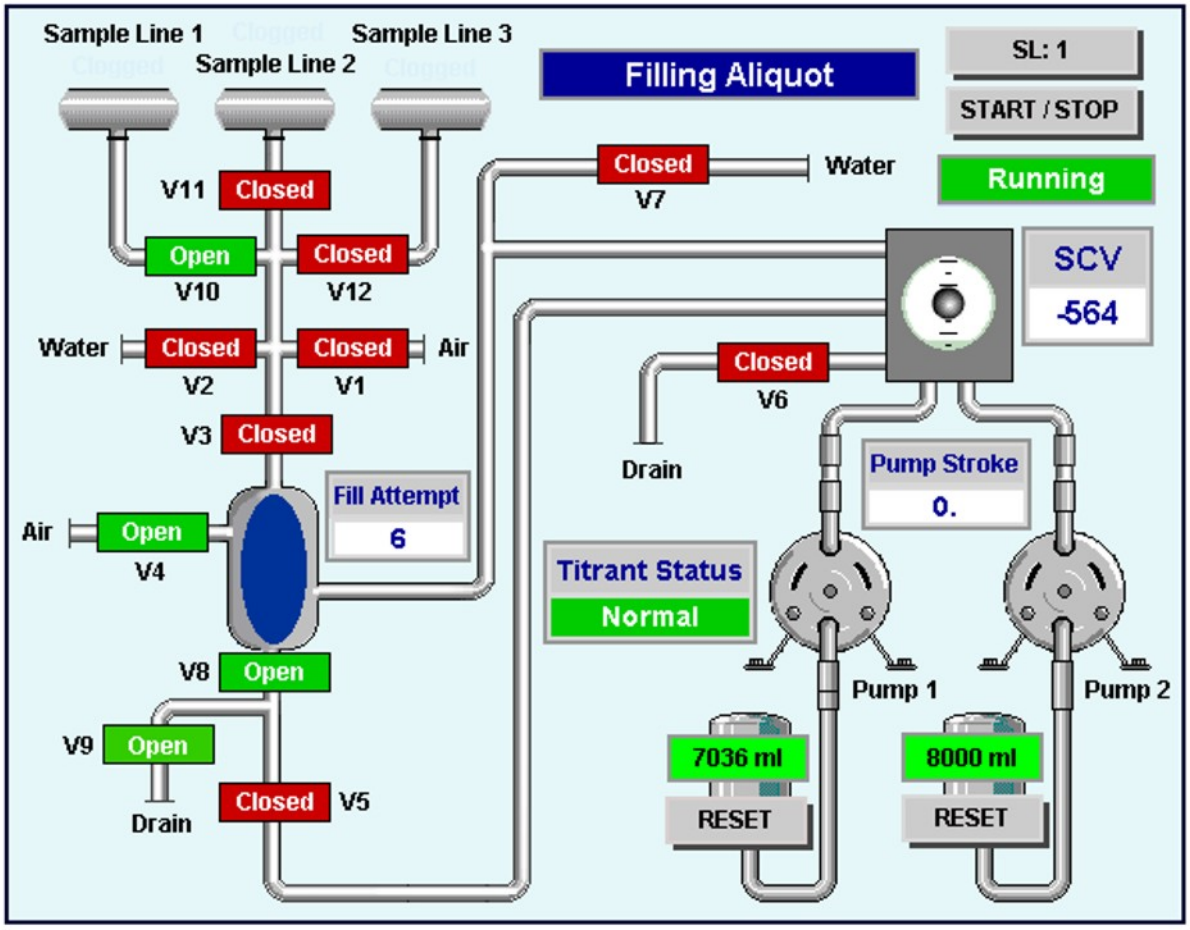
Valves 5, 6, and 8 open, draining the Sample Reservoir, Aliquot Dispenser, and Sensor.



Valve 1 opens, forcing air through the filter.

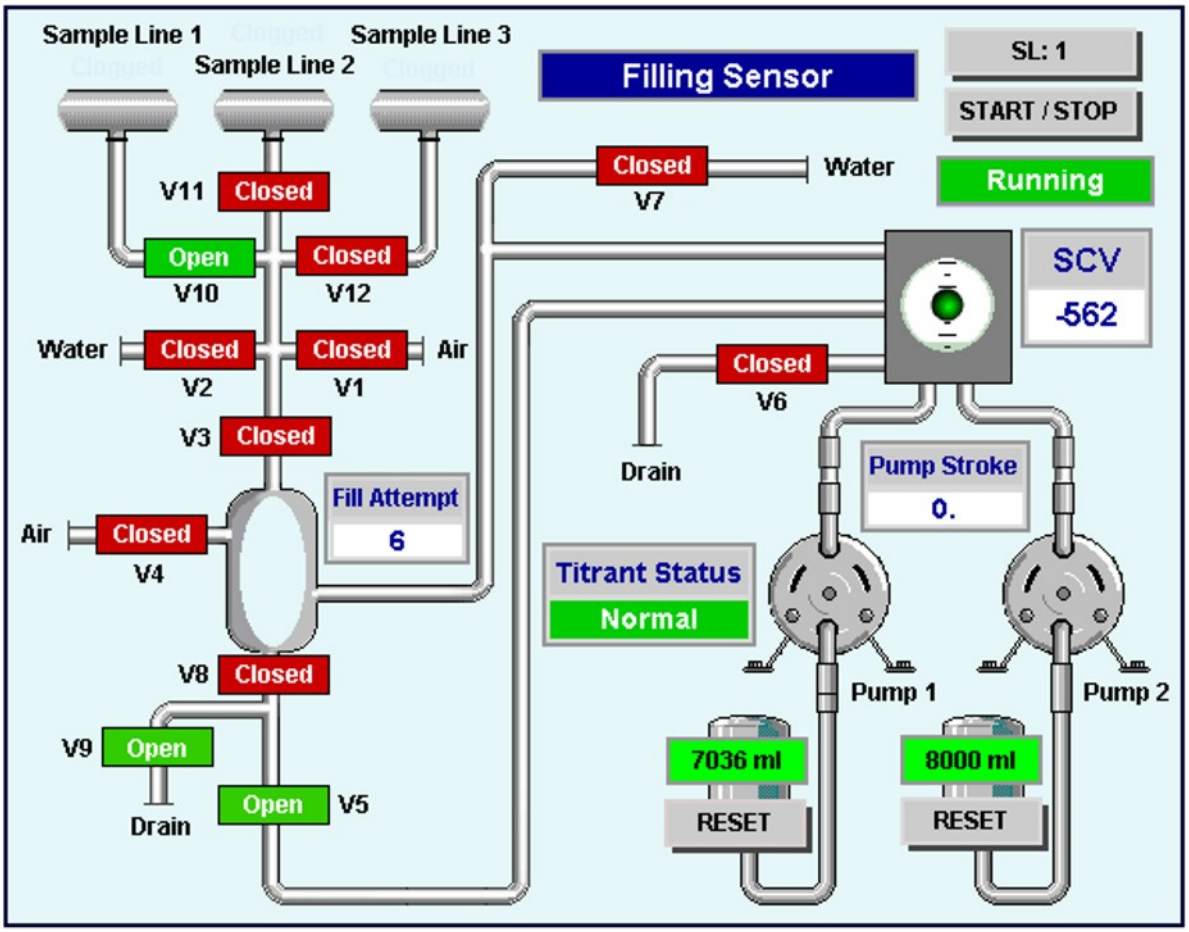
After Valve 1 closes, a short delay occurs before Valve 3 opens, which allows filtrate to drain into the Sample Reservoir.

This is repeated until the Level Detector is activated, which is indicated by the reservoir graphic turning blue. Notice that the "Fill Attempt" text box next to the reservoir keeps track of how many times Valve 3 has to open to collect a sample.

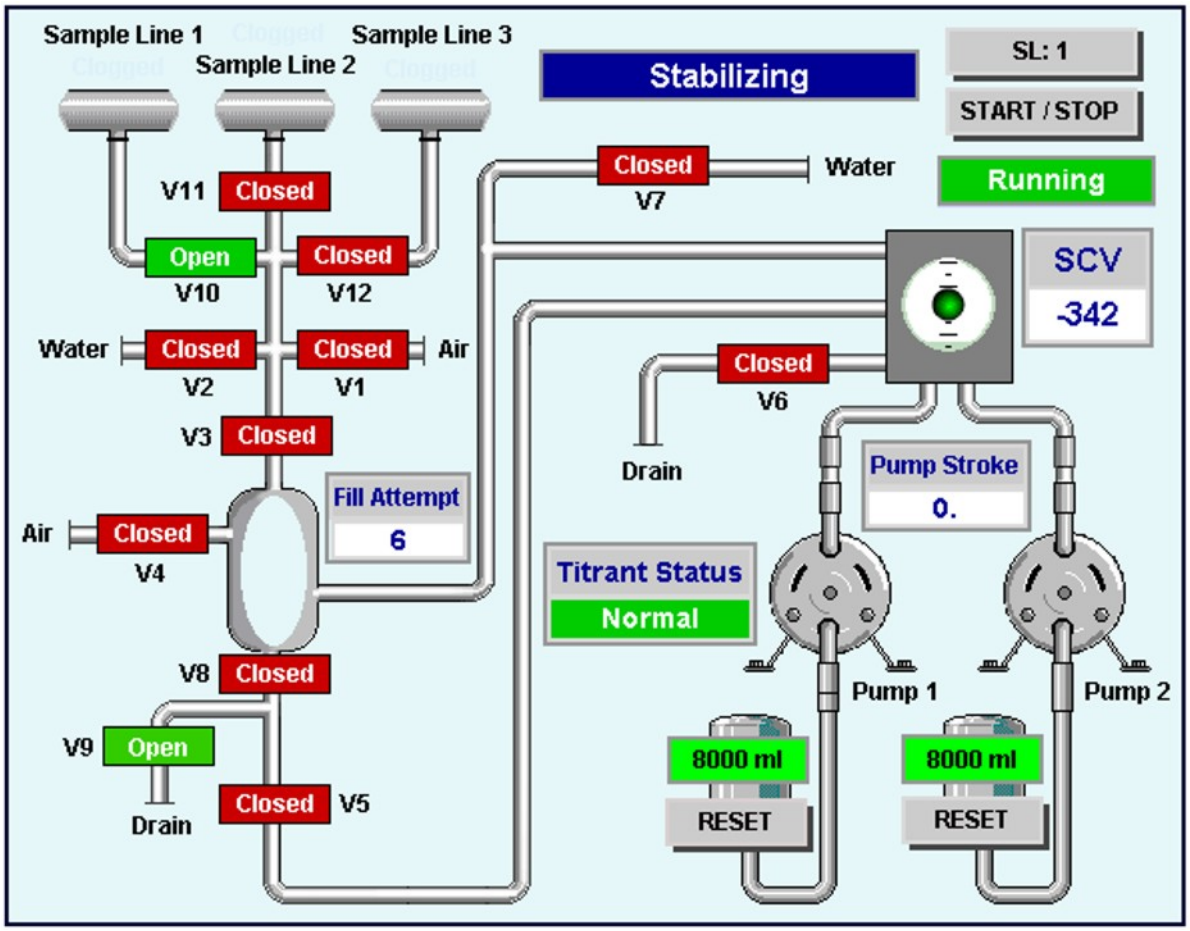


Valve 4 opens, pressurizing the Sample Reservoir.

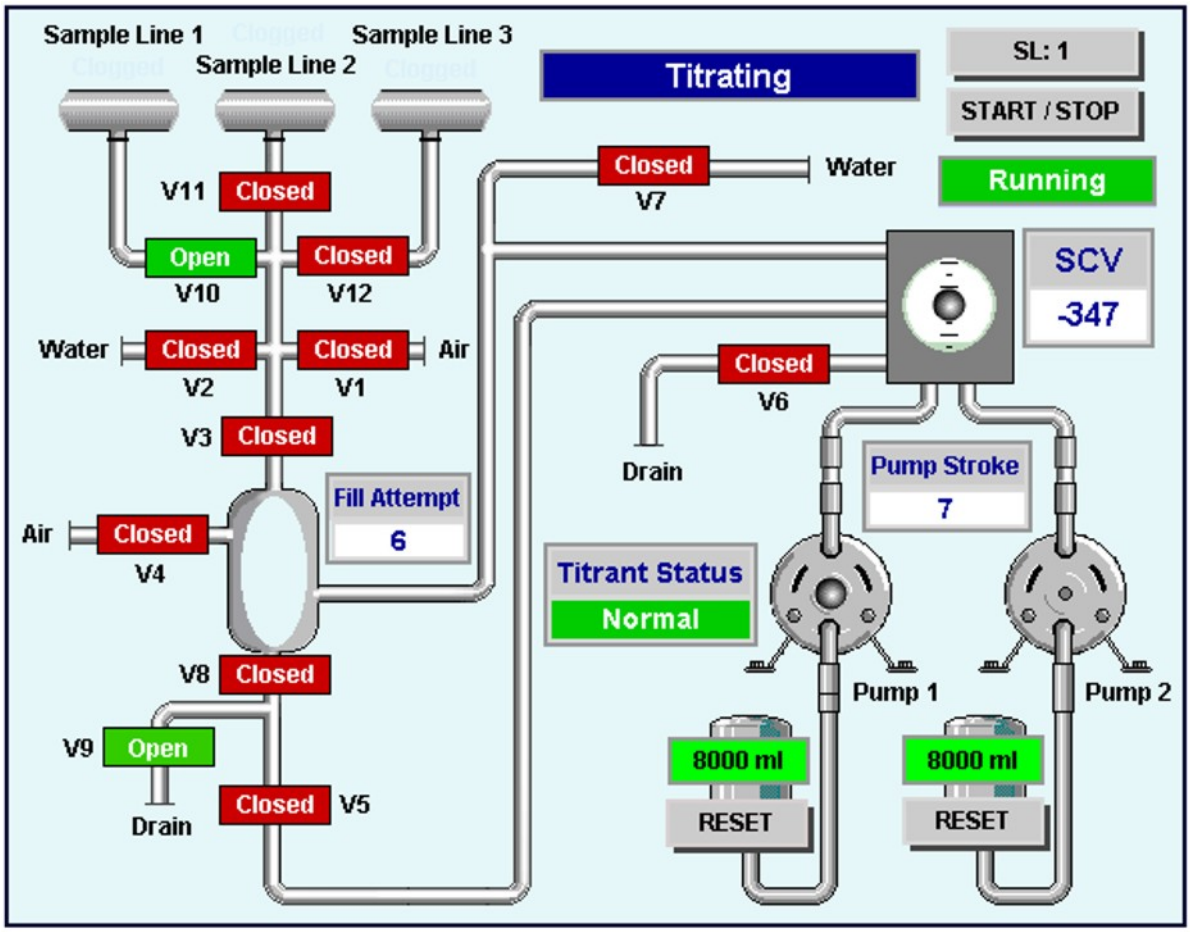
Valve 8 opens, allowing the filtrate in the Sample Reservoir to fill pH/conductivity chamber and the Aliquot. The excess goes to drain.



Valve 5 opens, emptying the Aliquot Dispenser into the Sensor.



Once the Sensor has been filled, the Streaming Current reading is allowed to stabilize.



Pump 1 or Pump 2 begins adding titrant (the active pump is indicated by a green flashing light).

As the Streaming Current Value approaches zero, the addition rate slows.

Once the value reaches zero, the outputs are updated and the sample is drained.

The number of Pump strokes is displayed in the text box located between the pump graphics.

Once the titration is complete, the amount of titrant used is subtracted off from the volume readout on the titrant jug graphics. The Reset button is used to reset the titrant volume to 8000 mL after the jugs have been refilled.

4.3 CHARGE DEMAND TITRATION

CHARGE DEMAND quantifies the number of charges in a volume of furnish. As explained in Section 1.1, a titration is performed on the sample by adding a polymer (titrant) of opposite charge and known charge density. Therefore, the CHARGE DEMAND may be expressed in mL of titrant consumed by the sample.

Since the titrant charge density (titrant normality with units of equivalents/L) is also known, the CHARGE DEMAND may be converted from mL to milliequivalents/L (meq/L) or microequivlanents/L (μeq/L):

$$\textbf{CHARGE DEMAND (meq/L)} = \frac{\textbf{Titrant Consumed (mL) * Titrant Normality (eq/L) * 1000}}{\textbf{Sample Volume (mL)}}$$

*For μeq/L, the above formula uses a multiplier of 1,000,000.

Section 4.4, "Setting Parameters," explains how to display the CHARGE DEMAND in either mL or equivalents.

Additionally, Section 4.4 explains how to switch the ECT between two different PUMP MODES. The two different modes are explained in the following subsections.

4.3.1 Cationic / Anionic Titrant Mode Setup (PUMP MODE = +/-)

The Cationic / Anionic mode (Pump Mode = +/-) is desired when the incoming samples to be tested have the potential to be cationic or anionic. In this mode, the ECT will use PUMP 1 to titrate an anionic sample with cationic polymer. PUMP 2 will be used to titrate a cationic sample with anionic polymer. Ensure that the titrant containers are filled according to this protocol (Pump 1 = Cationic, Pump 2 = Anionic).

4.3.2 Dual Cationic Mode Setup (PUMP MODE = ++/+)

The Dual Cationic mode is desired when the incoming samples will always be of the same charge (anionic), and also have significant differences in demand (i.e. headbox vs. blend chest). Thus, titrants of the same charge with different normalities can be used to titrate the samples. Using different normality titrants on samples with different demand characteristics can greatly improve the titration results.

Note: The titrant with a higher normality must be fed through PUMP 1. The ECT will begin with this titrant, and subsequently determine which titrant normality to use.

The ECT will automatically switch between titrant strengths depending on the previous charge demand for each sample line. The operator enters the critical value (see Section 4.4) and the deadband that the ECT uses to decide which pump (or in

other words, which normality titrant to use). Thus, when the CHARGE DEMAND exceeds the critical value + the deadband value, the stronger titrant will be used from PUMP 1 and the volume of titrant added will be optimized. When the CHARGE DEMAND from the previous titration is below the critical value, the weaker titrant will be used from PUMP 2. The purpose of this mode is to analyze samples with a large variation in CHARGE DEMAND.

NOTE: In PUMP MODE ++/+, all outputs can be normalized to the titrant strength of PUMP1. Example: PUMP 1 contains 0.005N Dadmac and PUMP 2 contains 0.001N Dadmac. When PUMP 1 is used to titrate 1.6 ml, the output will be 1.6 ml. However, if PUMP 2 is used to titrate 5.5 ml, the output will be normalized to the stronger normality and will indicate 1.1 ml of titrant consumed.

4.3.3 Switch On Empty (Pump Mode = Mode 3)

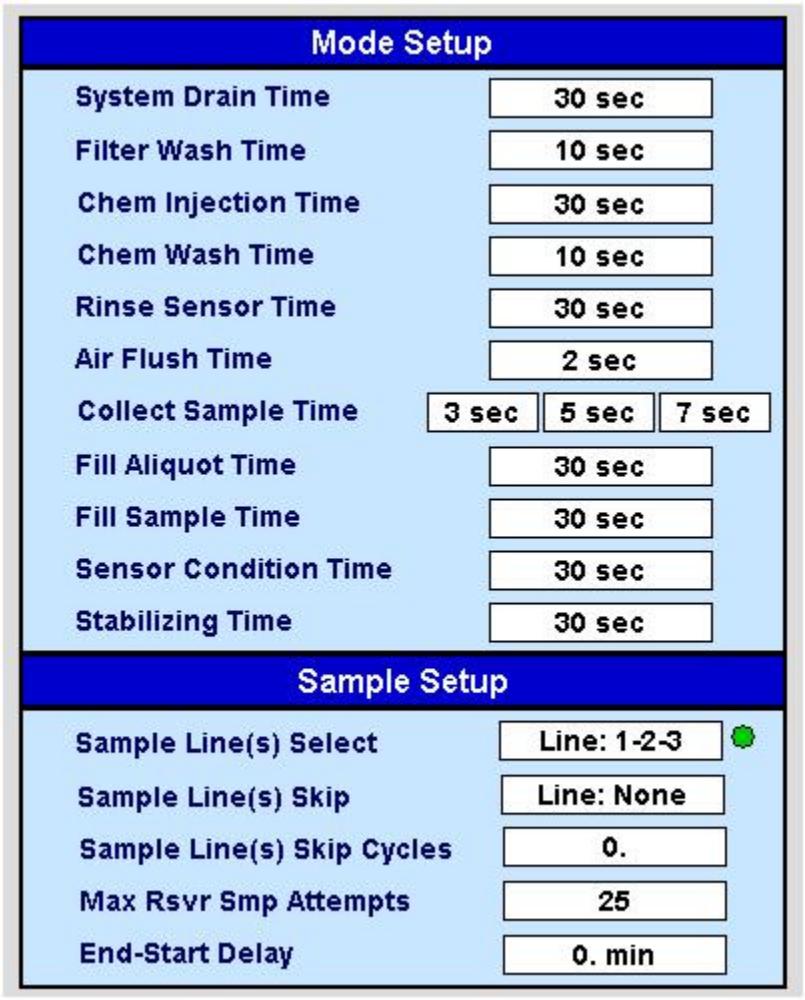
This mode is used when both titrant jugs contain the same normality titrants. Mode 3 will automatically switch from one pump to the other when one of the jugs runs empty.

4.3.4 Titration Speed

The speed at which the pumps titrate as the reading approaches zero can be changed for each sample line in order to reduce any titration overshoot. See section 4.4.

4.4 SETTING PARAMETERS

4.4.1 Time Setup



Mode Setup

Drain Sample Time shoule be set for 30 to 45 seconds. Ensure the time is set long enough to expel all sample and rinse water from the reservoir, aliquots, and sensor. The drain tubing from valve 6 should have at least 10 seconds of air blowing out after the bulk volume of liquid is expelled.

Filter Wash Time should be set for 5 to 15 seconds. Longer filter wash times may be required for furnishes that have more fillers and/or recycled material.

Chem Injection Time should be set for 10 to 15 seconds.

Chem Wash Time should be set for 45 to 90 seconds.

Rinse Sensor Time should be set for 90 to 180 seconds. Longer Rinse times will help reduce required sensor maintenance.

Air Flush Time should be set for 2 to 5 seconds.

Collect Sample Time should be set for 5 to 15 seconds. There are three settings, each is for a separate line. The first setting is for line 1, the second for line 2, and the third for line 3. Adjust the Collect Sample times to optimize sample collection speed on each individual line.

Fill Aliquot and Fill Sensor Time should be set for 15 to 30 seconds. Ensure the time is long enough to allow all the sample to be transferred from the reservoir to the aliquots and then to the sensor.

Sensor Condition Time and Stabilizing Time. These should be set for 30 to 60 seconds. Ensure the reading is not still changing rapidly prior to the start of the Titrating mode.

Sample Setup:

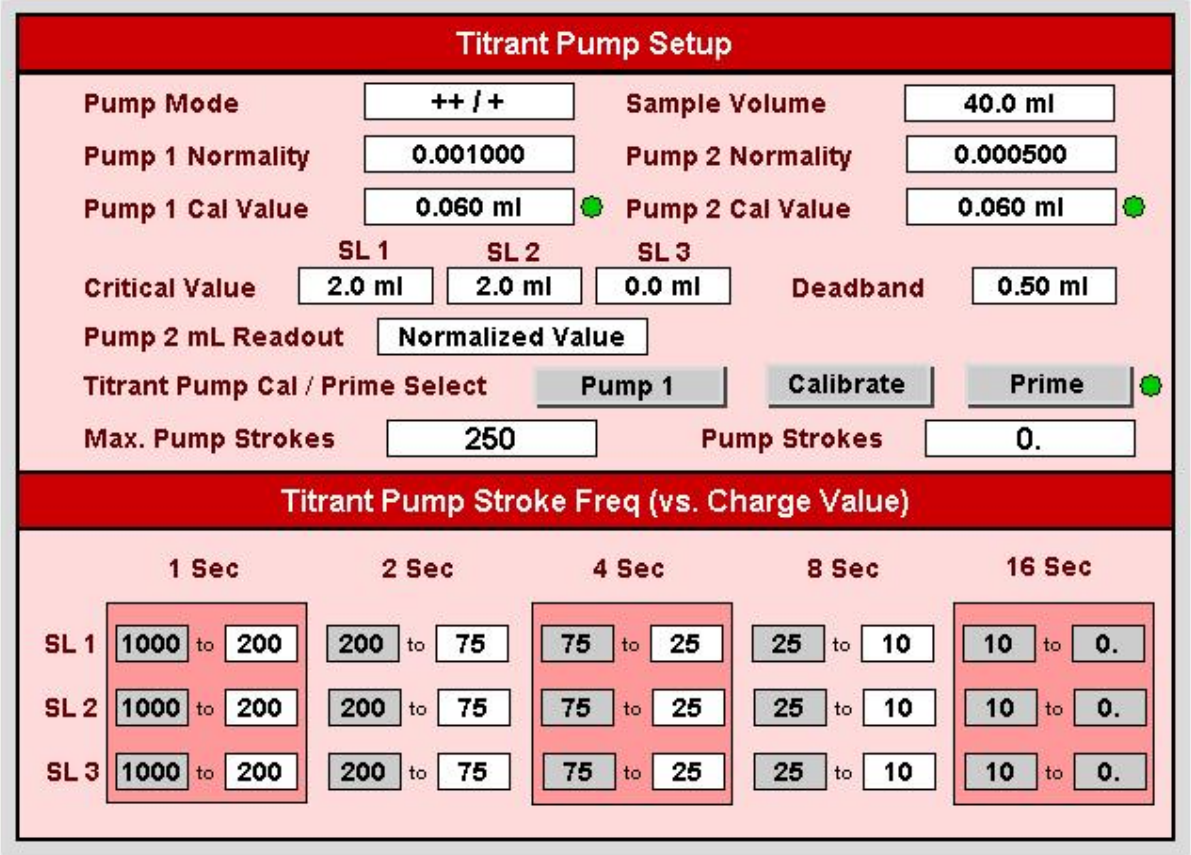
Sample Line Select should be set for whichever lines that are being used at that time.

Sample Line Skip and Sample Line Skip Cycles allow the user to setup the ECT so that it runs more samples on one line than another. Select which lines that do require as much data collection and then enter the number of times the line should be skipped before a sample is measured.

Max Reservoir Sample Attempts should be set for 25 to 100. During Sample Collection mode, if Valve 3 opens more times than the Max Rsvr Smp Attempts is set for, an alarm will be activated showing that the Filter is clogged.

End Start Delay is used to put a delay between the ECT moving from one sample line to the next after a titration is complete.

4.4.2 Pump Setup



Pump Mode selects either (+/-) Anionic / Cationic titrant mode, (++/+) Dual Cationic Mode with two different strength titrants, or Mode 3. Mode 3 is used when there is only a need to use one strength cationic titrant. In this instance, both titrant jugs can be plumbed up together to both pumps. When using Mode 3, in the event that Pump 1 should fail, then Pump 2 will automatically be used.

Sample Volume is the amount of sample collected in the aliquot and transferred to the sensor for titration. This is normally set at factory.

Pump 1 and **Pump 2 Normality** are the strengths of the titrant. If using Pump Mode ++/+, the stronger normality must be used in Pump 1.

Pump 1 and **Pump 2 Cal Value** are the volume per stroke from the respective pumps. These are set during the Pump Calibration.

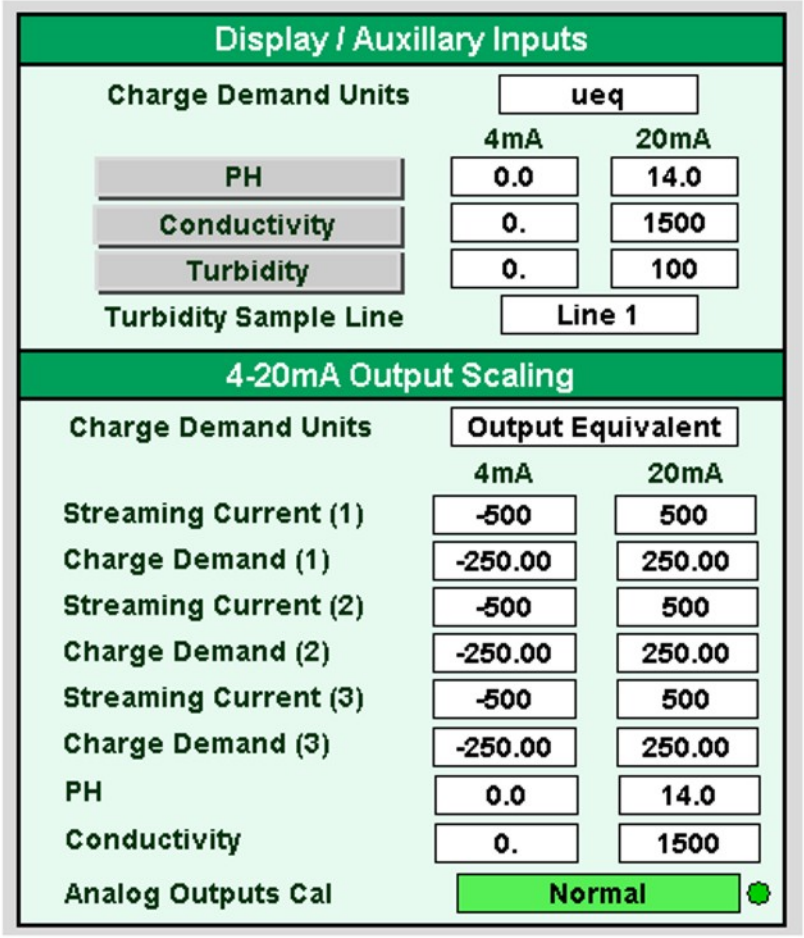
Critical Value is shown only when the Pump mode is ++/+ . The critical value determines when Pump 2 is used. If Pump 1 is used, but the volume drops below the critical value, the next titration on that sample line will use Pump 2 (the weaker titrant).

Deadband is used to prevent the titration from going back and forth between Pump 1 and 2 when the demand is right at the critical value. In order to go back to Pump 1, Pump 2 must deliver a normalized volume of titrant that exceeds the critical value + deadband volume.

Titrant Pump Selection is used to determine which pump is to be calibrated. The Initiate button will activate the pump for 50 strokes. This function is also used to prime the pump if necessary. When calibrating the pump, collect the sample in the 10 mL graduated cylinder and measure the volume once the 50 strokes are finished. Divide the volume by 50 to get the stroke volume. Enter this value as the Pump Cal Value.

Titrant Pump Stroke Freq (vs. Charge Value) is used as a speed control for the pumps during titration. The pumps are capable of stroking at 5 different speeds: 1 sec, 2 sec, 4 sec, 8 sec, and 16 sec. Sample with low charge demand may require slow pump speeds (e.g. 4 sec, 8 sec, and 16 sec) to prevent an overshooting of the endpoint, while samples with high demands may require faster pump speeds at the start to ensure the titration is completed in a timely manner.

4.4.3 Input / Output Setup



Display / Auxillary Inputs

Charge Demand Units determines how the charge demand values are displayed. The choices are meq, µeq, or mL.

PH, Conductivity, and Turbidity are all options that may or may not have been supplied with your unit. If any of these Auxillary sensors were supplied, then activate the sensor by Right clicking on the gray box with the Sensor's type (e.g. PH, Conductivity). To the right of the gray box are the 4 and 20 mA scaling prompts for the sensor. The values in these prompts must match what the analyzers are actually scaled for.

4-20mA Output Scaling

Charge Demand Units is used to determine whether you wish to output the Equivalents value (meq or µeq) or the mL value.

Streaming Current Output is used to scale the 4 to 20 mA outputs for each sample line.

Charge Demand Output is used to scale the 4 to 20 mA outputs for each sample line.

Analog Output Cal is used to calibrate the outputs at 4, 12, and 20 mA. Set this setting for Normal when not calibrating.

5.0 MAINTENANCE

The following is a general timetable for routine maintenance.

Every Week to Two Weeks

1. Check titrant levels: Section 5.1
2. Check Chemical Carboy level: Section 5.4
3. Clean the probe and piston assembly: Section 5.3

Every Month

1. Clean filters and check for defects: Section 5.2
2. Recalibrate the titrant pumps: Section 5.7

Every 6-12 Months

1. Replace fouled tubing: Section 5.5
2. Replace filters: Section 5.2
3. Clean the sample reservoir and check the float switch: Section 5.6
4. Clean valves Section 5.8
5. Replace Probe & Piston: Section 5.3
6. Check tubing in Chem Feed Pump: Section 5.4

5.1 REFILLING TITRANT CONTAINERS

There are two 8 Liter titrant jugs on the lower backside of the ECT. These jugs will need to be filled with a cationic (POLYDADMAC) and/or an anionic (PVSK) titrant. (In most instances, anionic titrant is not used). To prevent the titrant jugs from running dry, it is recommended to refill them when they reach half full.

Commercially available titrants typically come in one of two strengths, either a .001 N or a .005 N. Chemtrac recommends that the user purchase the .005 N and dilute this titrant to the proper strength. This will save on cost and on the total volume of titrant that will need to be kept on hand.

It is ideal to select a titrant strength which results in titration volumes between 1.5 to 4 mL. If the titration is using more or less than 1.5 to 4 mL on average, than it is recommended to change titrant strength. Using the Dual Cationic (++/+) Pump strategy, a stronger cationic titrant can be used on Pump 1 and a weaker titrant on Pump 2. For example, Pump 1 may have a titrant strength of .001 N while Pump 2 has a strength of .0005. This would allow the ECT to cover a broader range of charge demand while producing accurate results. The following table will help you choose the titrant strength best suited for your "average" Charge Demand and instruct you on solution mixtures.

Titrant Selection and Makedown Chart

Titrant Normality (N)	Low End Demand (µeq)	High End Demand (µeq)	1000 mL Solution Mixture .005N Titrant + Distilled H2O	1000 mL Solution Mixture .001N Titrant + Distilled H2O
0.005	150	750	(1000 mL .005) + (0 mL H2O)	N/A
0.0045	135	675	(900 mL .005) + (100 mL H2O)	N/A
0.004	120	600	(800 mL .005) + (200 mL H2O)	N/A
0.0035	105	525	(700 mL .005) + (300 mL H2O)	N/A
0.003	90	450	(600 mL .005) + (400 mL H2O)	N/A
0.0025	75	375	(500 mL .005) + (500 mL H2O)	N/A
0.002	60	300	(400 mL .005) + (600 mL H2O)	N/A
0.0015	45	225	(300 mL .005) + (700 mL H2O)	N/A
0.001	30	150	(200 mL .005) + (800 mL H20)	(1000 mL .001) + (0 mL H2O)
0.0009	27	135	(180 mL .005) + (820 mL H2O)	(900 mL .001) + (100 mL H2O)
0.0008	24	120	(160 mL .005) + (840 mL H2O)	(800 mL .001) + (200 mL H2O)
0.0007	21	105	(140 mL .005) + (860 mL H2O)	(700 mL .001) + (300 mL H2O)
0.0006	18	90	(120 mL .005) + (880 mL H2O)	(600 mL .001) + (400 mL H2O)
0.0005	15	75	(100 mL .005) + (900 mL H2O)	(500 mL .001) + (500 mL H2O)
0.0004	12	60	(80 mL .005) + (920 mL H2O)	(400 mL .001) + (600 mL H2O)
0.0003	9	45	(60 mL .005) + (940 mL H2O)	(300 mL .001) + (700 mL H2O)
0.0002	6	30	(40 mL .005) + (960 mL H2O)	(200 mL .001) + (800 mL H2O)
0.0001	3	15	(20 mL .005) + (980 mL H2O)	(100 mL .001) + (900 mL H2O)
0.00005	1.5	7.5	(10 mL .005) + (990 mL H2O)	(50 mL .001) + (950 mL H2O)

* Once a titrant strength has been selected, be sure to enter the current normality being used on the **Pump Setup** screen.

The titrants, which are available in 1 Liter, 4 Liter, and 20 Liter containers, can be ordered directly from NALCO™. You can contact customer service in the United States at 708-496-7000 or toll free at 800-879-8708.

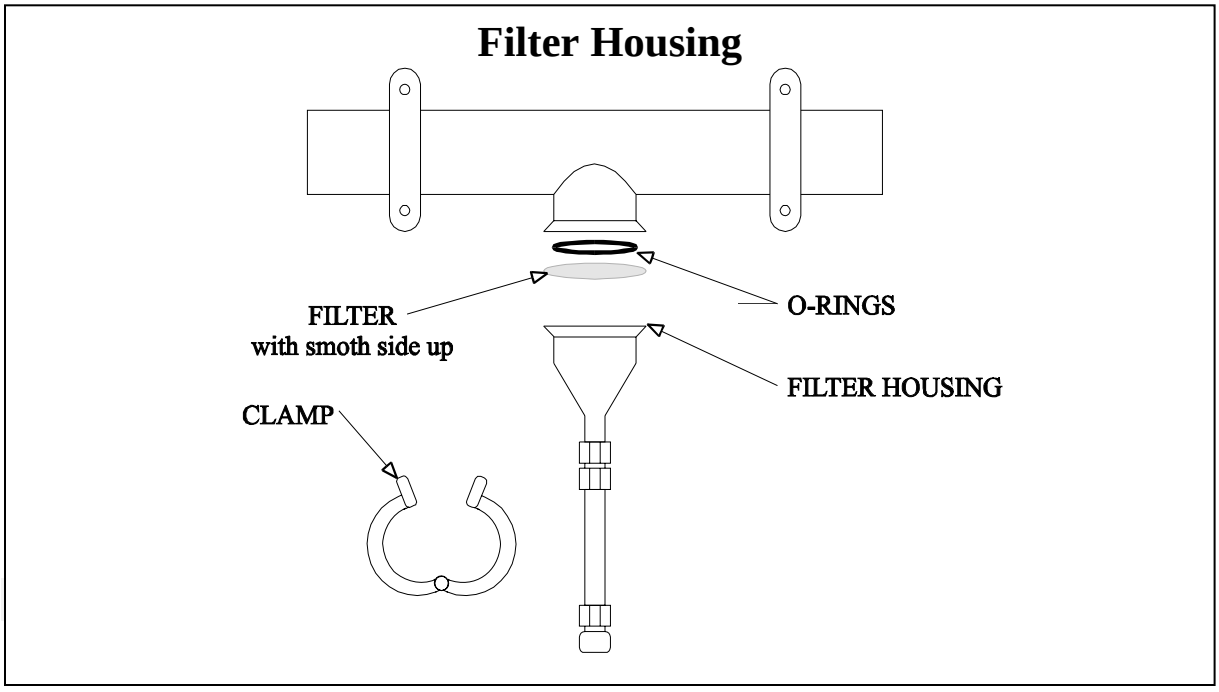
Alternatively, the operator may choose to use a process additive. In doing so, a specific application may be analyzed or optimized. The limitation is that the data will not be universally applicable.

5.2 FILTER REMOVAL AND CLEANING

Only remove filters on sample lines that have been properly flushed. **(DO NOT ALLOW STOCK TO GET BEHIND THE FILTER.)** Before the filter can be removed, the system must be shut down and the lines flushed. Stop the ECT and flush the sample line using the manifold valve overrides. First override the sample line valve (10, 11, or 12) and then override valve 1 and 2. After 30 seconds, shut off valve 2. After another 30 seconds, shut off valve 1 and the sample line valve.

1. Remove clamp on filter housing.
2. Pull back on housing and remove filter. With the filter removed, use a mild cleaning agent and gently clean the filter. Brushing may be necessary to remove deposits. Remove all material build-up, and then thoroughly rinse.Replace with a new filter if deposits cannot be removed.
3. Replace filter and **ENSURE THAT THE SMOOTH SIDE FACES UP**. Also ensure that the o-rings on the upper and lower housing are in place.
4. Tighten clamp around housing.(hand tight is usually sufficient)

FIGURE 12



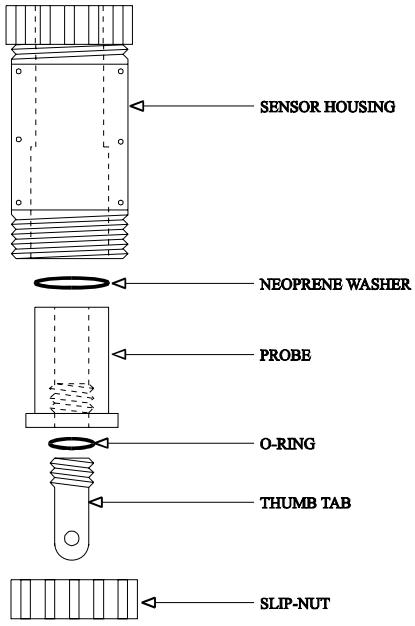
5.3 Probe and Piston Removal and Cleaning

Before removing the probe, **STOP** the operation of the ECT9800.

1. Unscrew bottom slip-nut on the sensor.
2. Pull down on thumb tab to remove probe cartridge. Then, disconnect the probe's cable from the ECT by unscrewing the connector located at the end of the cable.
3. Scrub the inside cylinder with a test tube brush and water to remove fiber buildup. A mixture of a mild abrasive cleaner (i.e. Comet, Ajax) and water can be used along with the brushing to remove deposits (1 tablespoon of cleaner per 250 mL of water). **DO NOT ALLOW THE CONNECTOR TO CONTACT WATER.**
4. The piston can be removed for cleaning by inserting the Piston Removal Tool into the sensor housing and turning the tool counterclockwise. You may need to rotate the shaft of the motor ½ a turn in order for the tool to come into contact with the piston. Note: The piston removal tool looks like a probe cartridge, but without the yellow cable attached, and it should be located in the lower enclosure.
5. Return piston, probe cartridge and tighten slip-nut.
6. Reconnect yellow cable.(connector is keyed and will only go on one way).
7. Turn Power back on and start the operation of the ECT9800.

FIGURE 13

Sensor and Probe Detail



5.4 Refilling Chemical Carboy & Servicing Chemical Pump

The Chemical Carboy is typically filled with hot water and detergent (e.g. dishwasher detergent like Cascade). It is advised to start off using ½ cup of detergent per 5 gallons, and increase amount if needed. Do not use any type of cleaner that will attack the following materials: Teflon, Delrin, EPDM, Viton, PVC, Stainless Steel.

The chemical feed pump is a peristaltic pump and the tubing will need to be replaced approximately once every 2 to 3 years. Contact the factory for ordering information.

5.5 REPLACEMENT OF PLASTIC TUBING

Although the plastic tubing seldom needs replacement, special circumstances may arise that warrant this procedure.

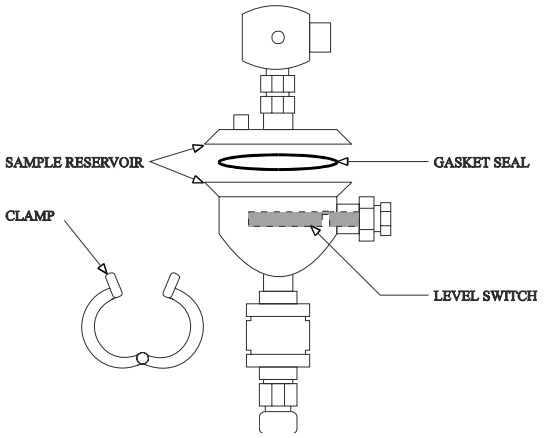
Before servicing any tubing, disconnect the power, turn off the air and water supplies, and bleed off back pressure from the air and water connections. Both pressure gauges should read 0 psi. To remove the tubing, press the quick release receptor away from the tubing and simply pull the tubing out. Cut a new piece of tubing to the same length as the old a piece and insert the tubing.

5.6 RESERVOIR AND FLOAT SWITCH CLEANING

A float switch is used inside the sample reservoir to detect the volume of filtrate during the sampling modes. Buildup or damage to the switch can interfere with the operation of the ECT.

FIGURE 14

Reservoir Detail



1. Stop the ECT.
2. Remove clamp on reservoir and lower bottom portion containing level switch.
3. Clean switch and inner walls of the reservoir.
4. Raise and lower float of switch. Float should move freely. On the Status page, check to ensure the reservoir graphic turns blue when the float switch is held up.
5. Replace clamp and hand tighten.

It should not be necessary to remove the float switch from the reservoir base. However, if it becomes necessary, secure the float to the body of the switch to prevent movement. This will prevent the float from bending against the water nozzle located inside the reservoir.

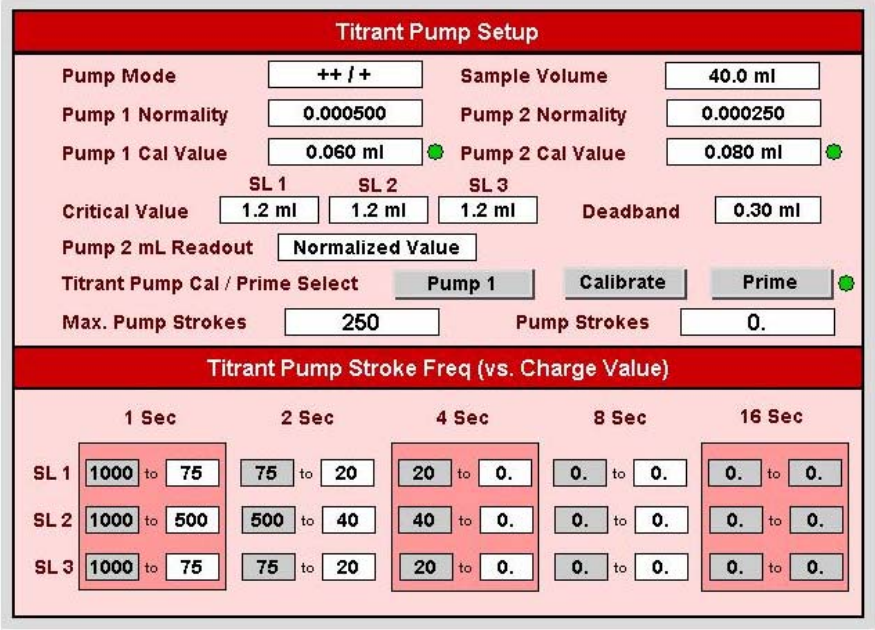
5.7 TITRANT PUMP CALIBRATION

Calibration of the pump determines the precise volume of titrant delivered by each pump stroke. This is necessary when the unit is initially set up, when the pump rate is manually changed using the adjustment screw, or if the titrant normality is changed. There are two (2) titrant pumps on the ECT9800. It is recommended to calibrate these pumps on a monthly basis (approximately every other time the titrant jugs are refilled). This procedure will cover how to calibrate the pumps. The only tools required should be located in the lower enclosure of your ECT9800. The tools needed are: 10 mL graduated cylinder.

To calibrate the pump:

1. You will first need to stop the ECT using the Touchscreen Display and Locate the Pumps (the pumps are located in the bottom enclosure to the right of the sensor assembly, see figure 2 on page 10).
2. Remove the tubing from the check valve barb fitting (located on the sensor housing) and connect this tubing to the calibration check valve. Place the calibration check valve into the 10 mL graduated cylinder to collect the dispensed titrant.
3. On the navigational bar (see figure 2) click on **Pump Setup**. The pump setup screen , shown in figure 15, should appear.

FIGURE 15



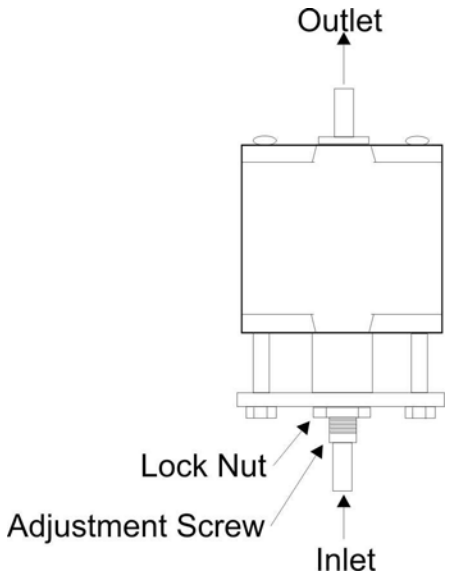
4. Next to where it says **Titrant Pump Cal / Prime Select**, ensure the system is set to calibrate **Pump 1**. If your screen shows Pump 2, then right click on the button showing Pump 2 and a command prompt will come up asking you which pump you wish to calibrate, select **Pump 1**.

5. Next, right click on the **Prime** Button and select "Priming On" from the drop down list. Allow the Pump to stroke at least 25 strokes, and ensure all the air is out of the calibration port (and any attached tubing) and that titrant is coming out of the port.
6. Next, empty out the 10 mL graduated cylinder and place it back underneath the calibration port (or if tubing is attached to the port, insert the tubing into the graduated cylinder). Then, right click on the **Calibrate** button and wait for the Pump to stroke 50 times. The Pump will stop on its own when it reaches 50 strokes. The green background will return to gray in color when the calibration is finished.
7. Hold the 10 mL graduated cylinder at eye level and measure the total volume dispensed (normally this will be between 3 to 4 mL). Record the result and repeat Step 7.
8. You should now have two results. If the results are within acceptable limits (+/- .2 mL), then take the final result and enter it into the **Pump 1 Cal Value** field. Simply right click on the field and a message box will appear allowing you to type in the result.
9. **NOTE: If the dispensed volumes do not match up within +/- .2mL, perform the calibration 2 more times. If the 3rd and 4th results match up within .2 mL of the 2nd result, then use the last result to calculate the per stroke volume (or calibration value). If they do not agree within .2 mL of each other, contact the factory to discuss pump replacement.**
10. **NOTE: If the new calibration value does not agree within +/- .4 mL of the old value, it is recommended to perform the calibration again in one week to verify the Pumps output is not becoming unstable (which can be caused by worn seals in the pump). If a follow up calibration is performed within 1 to 7 days of the original calibration, the results should agree to within +/-.2 mL of each other. If you suspect a Pump is becoming unstable, contact the factory for assistance.**
11. **NOTE: The dispensed volume for the calibration should be maintained above 2.5 mL. If the volume drops off below 2.5 mL, or if you feel the Pumps dispensing volume needs to be adjusted, follow the procedure on the following page.**
12. Repeat steps 5 through 11 for **Pump 2**.

ADJUSTING THE TITRANT PUMPS

If the Pump requires adjustment, a ¼'' and a ½'' open ended wrench will be required (a ¼'' open ended wrench should have been supplied with the unit).

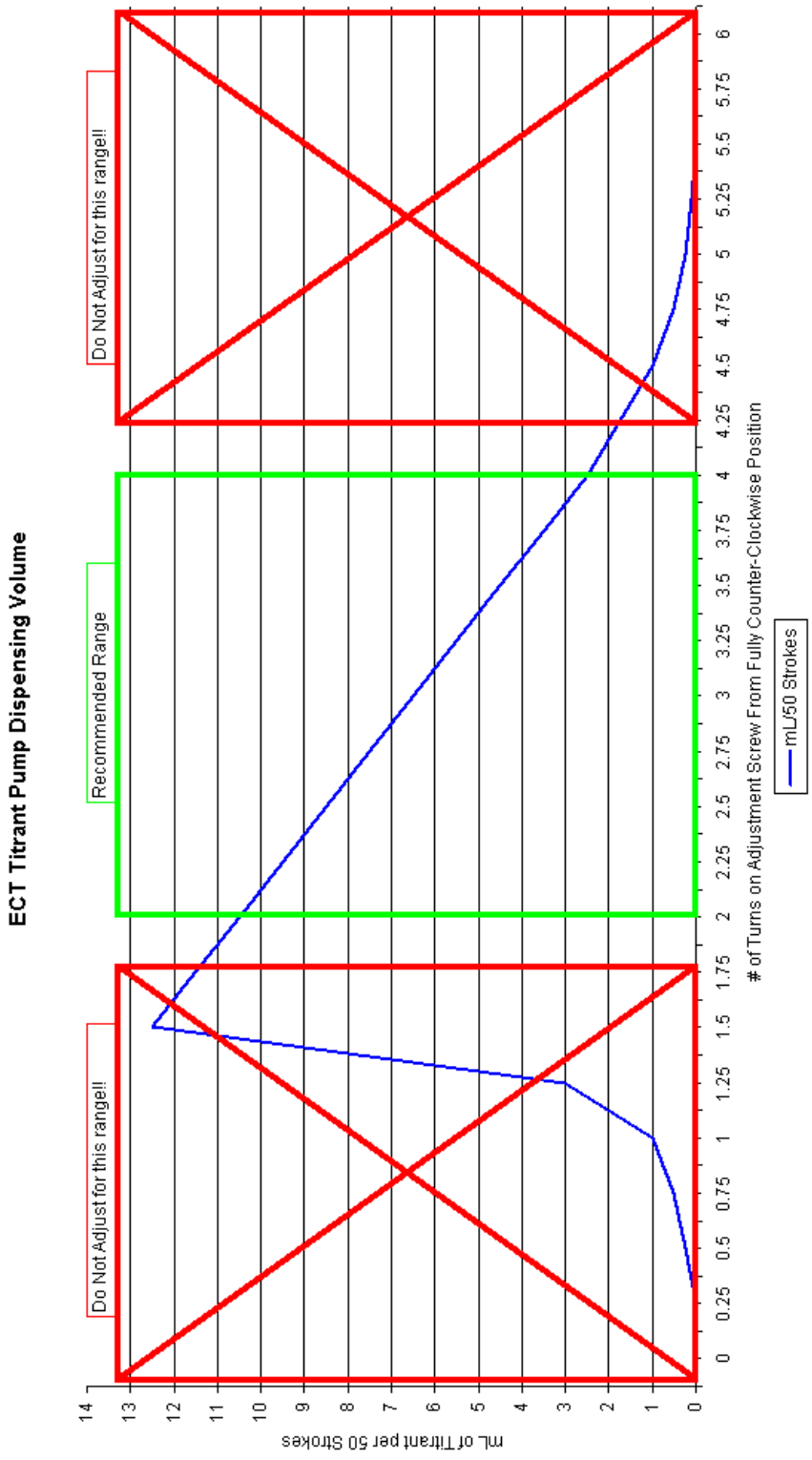
1. First, unloosen the Lock Nut using the ½'' wrench.



2. Placing the ¼'' wrench on the flat surfaces of the adjustment screw, make small 1/8 to ¼ adjustments to adjust for the dispensing volume desired. Turn the adjustment Clockwise to decrease dispensed volume and Counter-Clockwise to increase volume. **Note: You should not have to turn the adjustment more than one full turn from its original position. If the pump's dispensing volume does not change with a ½ turn, contact the factory for instructions.**
3. After the desired output is reached, tighten the Lock Nut using the ½'' wrench and recalibrate the pump using the steps outlined in "ECT9800 Titrant Pump Calibration Procedure".

   The graph on the following page shows the approximate dispensing output versus the number turns of the adjustment screw. The pumps are normally adjusted for the 3.5 to 4 turn from fully CCW range. This should produce a dispensing volume of around 3 to 3.5 mL (for 50 strokes). This output range will ensure optimum resolution on the results; however, larger dispensing volumes may be required for highly anionic samples to ensure titrations do not take more than 3 minutes.

FIGURE 16


ECT Titrant Pump Dispensing Volume
Do Not Adjust for this range!!
Recommended Range
Do Not Adjust for this range!!
mL of Titrant per 50 Strokes
# of Turns on Adjustment Screw From Fully Counter-Clockwise Position
mL/50 Strokes

5.8 VALVE CLEANING PROCEDURE

There are four types of valves used on the ECT, but only two of which will require cleaning. The Lever Action valve (Valves 4D, 4P, 5, 6, and 7) and a Diaphragm Valve (Valve 9).

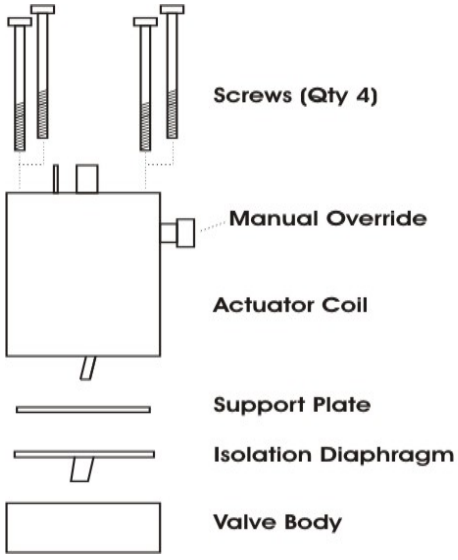
Before any of these valves are to be cleaned, the systems needs to be turned off and both the air and water lines going to the unit should be shutoff.

LEVER ACTION VALVES (TYPE 330 VALVE)

Special attention should be given to Valve 4D. This valve could require cleaning every 3 to 6 months. This valve is located on top of the reservoir and serves as a vent for the reservoir. If this valve gets plugged, the ECT will either not be able to collect a sample, or it will take several attempts (e.g. greater than 10) to get a sample. Valves 5 and 6 can also require some cleaning, normally once every 6 to 12 months. Valves 4P and 7 should never require cleaning as they are used to control instrument air and flush water and do not come into contact with the furnish.

Before cleaning a Lever Action valve, be sure to note the direction of the actuator coil because putting it back on 180 degrees backwards will cause the valve to not work properly. To avoid putting the actuator coil on backwards, take note which way the manual override button is pointing in reference to the valve seat and put it back on the same way when finished cleaning the valve. Also, be sure not to lose the isolation diaphragm and support plate when taking the valve apart.

Once the valve has been taken apart, simply clean the isolation diaphragm and the valve seat. Use as small brush, pipe cleaner, or Q-Tip to clean out the valve seat. For Valve 4D, use the spray gun to flush out the valve seat and fittings. It may be necessary to unscrew the valve seat from the piping so the ports can be fully cleaned out to remove any plugging.



5.9 PARTS LIST AND ORDERING INFO

Part Number	Description
	< 5 YEARS REPLACEMENT INTERVAL
	Probe Block Assembly Parts
8601	**Probe**
1701	**Piston**
8701	**Probe Washer**
1605	**Probe O-ring**
7701-A	**Double Thick Viton Seal**
3707	**Rod End**
5710	**Yoke**
13189	**Titrant Pump**
13902	**Sample Line Filter**
13192	**PH Probe (Optional)**
	BELOW PART #'S FOR REFERENCE ONLY, NOT PART OF SPARES LIST.
1308	**Opto Switch**
13194	**Conductivity Probe**
13550	**Float Switch**
5470	**110V Drive Motor**
330X	**Crank (For Large Motor)**
	Valves
13185	**Lever Action Valve (V4D, V4P, V5, V6, & V7)**
13171	**Angle Seat (V1, V2, V3, V8, V10, V11, V12)**
134076P	**Coil for 8 position manifold pilot valves**
9925340024	**160W 24 VDC Power Supply**
9928890024	**24W 24 VDC Power Supply**
EC181	**I/O Nodes**
WAC	**Web Access Controller**
F5D6130	**Wireless Access Point**

To get pricing and to order any of the above parts, contact Chemtrac Systems at 800-442-8722 or 770-449-6233.